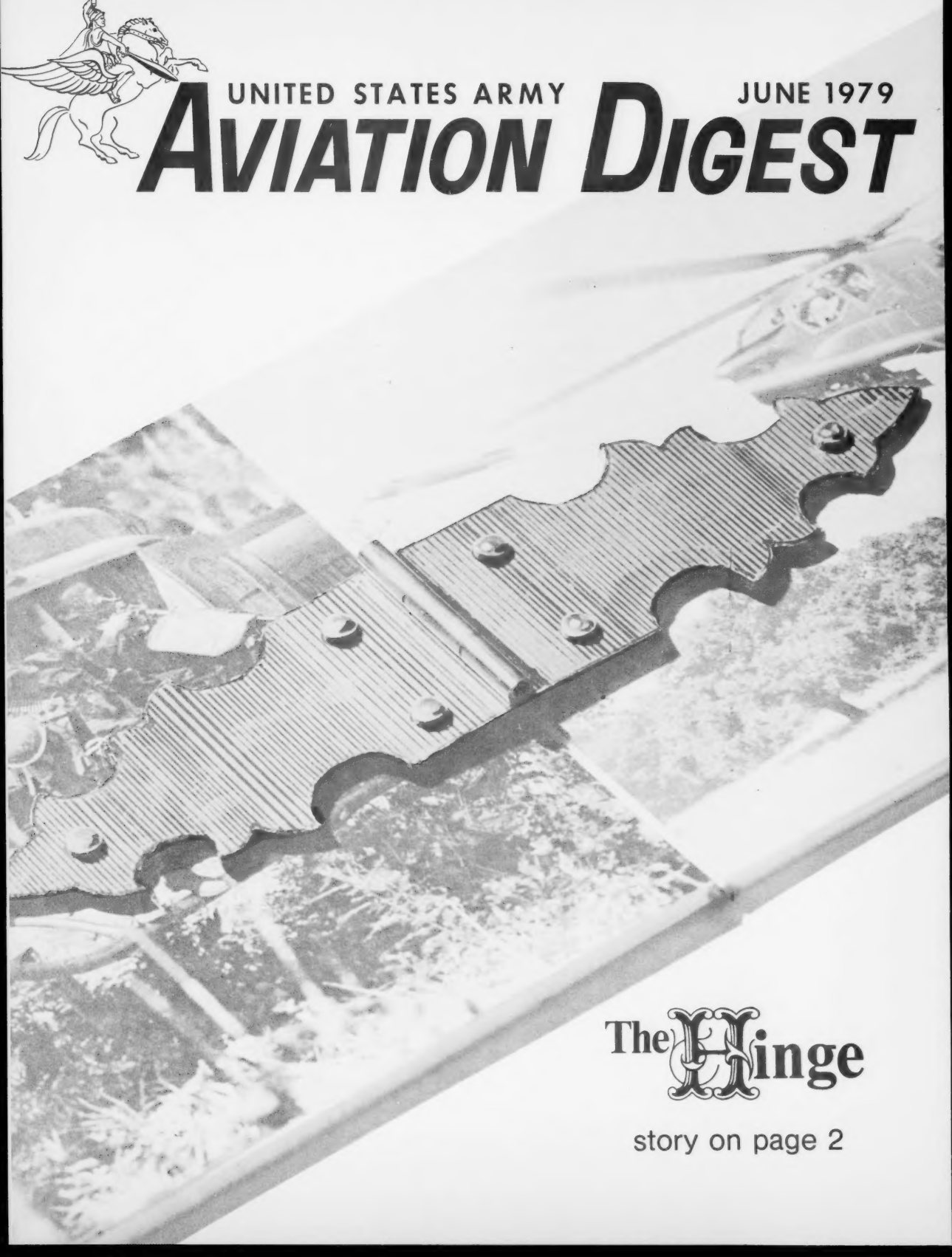
UNITED STATES ARMY

JUNE 1979

AVIATION DIGEST



The Hinge

story on page 2

UNITED STATES ARMY
AVIATION DIGEST
VOLUME 25 JUNE 1979 NUMBER 6

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ABOUT THE COVER

The hinge on the cover reflects the evolution of Army aviation tactics of Vietnam to those being developed today to fight and win on the high threat battlefield. See page 2. The *Aviation Digest* thanks the Aviation Center Photo Lab for the photography.

Richard K. Tierney
Editor

The mission of the *U.S. Army Aviation Digest (USPS 415-350)* is to provide information of an operational, functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine and other related data.

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Articles, photos and items of interest on Army aviation are invited. Direct communication is authorized to: Editor, *U.S. Army Aviation Digest*, P.O. Drawer P, Fort Rucker, AL 36362.

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VIEWS FROM READERS

Best wishes to Army aviation on its 37th birthday this June 6th

Editor:

With reference to CPT Charles Griffin's article in the January 1979 issue. This article gives a definition of VMC with reference to FAR 23. In the article a key word has been omitted, that key word with reference to inoperative engines specifically identifies the "critical" engine. A check of FAR 1.1 defines critical engine "means the engine whose failure would most adversely affect the performance or handling qualities of an aircraft." This of course would be the left engine in all Army fixed wing aircraft. With this in mind one must ask themselves what happens to the controllable airspeed when the noncritical engine fails? Of course the airplane is controllable below VMC. Your comments would be appreciated.

David F. Clemmer
9301 Montpelier Drive
Laurel, MD 20811

• **The *Aviation Digest* received the following from The United States Army Safety Center in response to Mr. Clemmer's letter:**

CPT Griffin's definition of VMC applies to multiengine aircraft in general. Aircraft with counterrotating propellers do not have a critical engine; however, as you point out, there is a critical engine on all Army fixed wing multiengine aircraft and that critical engine is the left one. If VMC computation is based on the left engine being inoperative, control of the aircraft is in fact possible at a lower speed in the event the right engine fails.

The intent of the article was to increase pilot awareness of single engine operations without becoming so technical in the process that pilots would not read the article. This was accomplished by providing the worst case situation that pilots might encounter thereby providing them with some margin of safety.

Editor:

Recently I have become a regular reader of your wonderful magazine *Aviation Digest.* I have found it extremely useful and full of vital information on aviation matters particularly rotary wing. I must congratulate you for it.

The write-up on "The Need For Instrument Training For Army Aviators" in the issue of September 1978 has been of particular interest to me. I, however, could not make out whether the hours (175/40—Army, 175/40—USAF, 130/25—Euro/NATO) indicated in figure 10 at page 36 are rotary wing hours only, or include fixed wing hours too. Also, whether the Initial Helicopter Training Program starts directly on helicopters, or the pilots have to fly fixed wing aircraft also before that; if so, how many hours on fixed wing and rotary wing each?

Yours sincerely,
A Heli - Operator
Bahrain

• **All training hours are rotary wing/rotary wing flight simulator.**

Editor:

The 50th Shock And Vibration Symposium will be held from 16 to 18 October at Colorado Springs, CO. The Air Force Academy will host the meeting at the Antlers Plaza Hotel. Contributed papers relating to the many aspects of the mechanical shock and vibration technology are solicited. Limited distribution and classified papers up to and including secret are encouraged. No specific session topics have been chosen; however, plans are being formed and suggestions for topics would be welcome. Further information may be obtained from:

The Shock and Vibration
Information Center
Code 8404, Naval Research
Laboratory
Washington, DC 20375
Telephone 202-767-2220
(AUTOVON 297-2220)

The Hinge

Major General William J. Maddox Jr.
United States Army, Retired

General Maddox, now retired, is a former commander of the U.S. Army Aviation Center and the Director of Army Aviation

IT IS EASY to accept success. It is much more difficult to know what to do with it.

In the summer of 1970, Army aviation was an acknowledged success. The Cambodian Campaign was over and the big drawdown of forces was beginning in earnest. Everyone knew that the helicopter rotor had carried the war in Southeast Asia for nearly 10 years. The helicopter had been central to every major ground combat action of the war. The personnel people counted 25,000 pilots in the forces against a total Army requirement of 26,000. They were flying 12,000 aircraft, mostly first line airframes built in the preceeding 5 years.

However, success at this point was a question-

able commodity. Already the forces of reaction were at work. On a national basis, the country had sworn off any more Vietnam-type interventions. Plans already were underway to cut one of the Army's two airmobile divisions from the structure. These were the combat units the Army had so dearly fought for after the Howze Board (The Army Tactical Mobility Requirements Board) and which had performed so admirably in combat. We in Army aviation had expected they would become the stepping stones for more aviation divisions.

Although the division reduction was in the cards, the force structure aviators were fighting hard to keep the number of airframes from being reduced drastically. This in turn would guarantee the retention of most of our combat experienced manpower and ensure a base for further development of aviation.

It is not abnormal in any organization for people to try to hold on to the status quo. The Army is no different. The people in the States had a proprietary interest in holding out against change. Thus, many did not want to make room for the large clot of aviation being redeployed from the combat zone following the Vietnam war. This feeling became especially acute when plans were approved to reduce the Army to about 13 active divisions. A compounding factor was that most of the divisions were to be mechanized.

On the hardware side, the AH-56 Cheyenne attack helicopter was in trouble. The Army had issued a stop-work order the previous year and Lockheed was facing bankruptcy. Lockheed had analyzed the failure in its rigid rotor system and had completed computer analysis demonstrating an acceptable fix. Yet it was unwilling to fund the hardware phase of the modification. So the entire Cheyenne project, worth about $1.6 billion, was marking time.

The Cheyenne problems deepened in the fall of 1970 when the Army Staff conducted an abortive demonstration for a large group from the Congress at the Yuma Proving Ground. Although the big bird flew well and delivered automatic weapons and rockets with excellent accuracy, it carried only one tube-launched, optically-tracked, wire-guided (TOW) antitank missile on its target run. This turned out to be a false economy when the missile dove into the sand in front of the launching aircraft. No backup was available to add the final punch to an otherwise successful demonstration.

What was even more damaging was the ill-fated attempt by the Combat Developments Experimentation Command (CDEC) to test the scout and attack helicopter team against armored formations at the Hunter Liggett reservation in California. Following the tests in late 1970, the Army reviewed the results of Experiment 43-5 and found that the kill ratio in some situations was reversed—the tank outkilled the helicopter. The reason seemed to be a lack of standardized tactics. Pilots participating in the test had been told in effect to devise their own tactics.

In light of these developments, it became obvious that aviation success in Vietnam was not readily translatable to other prospective combat environments. This situation pleaded for a new strategy. We needed to adjust our thinking to be able to operate in Europe, if we wanted to have any meaningful future. After all, the rest of the Army was being tailored in that direction.

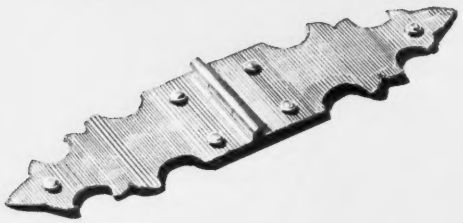
The problem facing aviation was nearly as great as General Eisenhower's task in 1943. We had to reestablish a beachhead on the continent. During the Vietnam war, most aircraft had been withdrawn from our European units together with most pilots and mechanics. Our chief obstacle was credibility. Very few believed that the helicopter could survive and could perform an essential role in a heavy combat environment.

The first step in preparing to establish our beachhead was to develop new tactics. Nap-of-the-earth flight was resurrected from early air assault division training experience. We needed to seek protection from the terrain to avoid the large aggregation of antiaircraft weapons that are known to accompany Warsaw Pact combat formations. Next, it was necessary to show that the helicopter could be useful.

Since 1939 the tank had been paramount on the European battlefield. It took a tank to do the main job of killing other tanks and forging breakthroughs in enemy lines. In this environment, airmobility seemed out of place. Our European Soldiers already were mounted. They worked in tracked vehicles and depended on track-mounted firepower. Because there are not nearly enough of them in Seventh Army, it was unreasonable to hold out a large airmobile reserve.

The challenge to the helicopter then was to determine how to do the job of tank killing more effectively than a tank. The answer seemed to lie in perfecting the techniques that we had been working with at CDEC. We needed to tie the survivable tactics to the lethality of the TOW wire-

The Hinge



guided missile. If the TOW were good enough for Infantry defenses, it would be even more effective with aerial mobility.

Fortunately, the Germans sensed the importance of the helicopter mounted TOW missile. In the summer of 1971, they borrowed a TOW equipped UH-1B, which had been placed in storage after the Army had made a decision to go into production with the Cheyenne. The UH-1B/TOW research and development (R&D) test program never had been completed.

The German Army designed a very severe test program for the TOW and achieved 55 target hits out of 60 firings. They then returned the UH-1B/TOW and the Army sent it and another R&D UH-1B/TOW to CDEC for further testing.

Then the North Vietnamese took a hand in the matter. Much higher concentrations of antiaircraft weapons than we had seen before accompanied the North Vietnamese regiments. And the SA-7 heat-seeking missile appeared for the first time. These weapons forced a tactics change on our aviation units.

Colonel Pat Delavan, Firepower Division Chief in the office of the Director of Army Aviation, was the father of the idea to send the old UH-1B/TOW aircraft to General Abrams in Vietnam. The aircraft were upgraded to C-model status and were manned by volunteer CDEC crews.

As soon as the TOW equipped machines arrived in Saigon, General Abrams put them through a training program before dispatching them to Hue. He intended to deploy them first to Hue but diverted to Pleiku where a tank thrust was expected. The TOW crews fought individual tanks for a week or more in the vicinity of surrounded Kontum before the North Vietnamese launched their tank attack into Kontum.

On the morning of 26 May, the TOW crews were called into action. It was quick and decisive. By 1000 hours, the TOWs had killed 10 tanks in the Kontum city defenses and broken up a North Vietnamese breakthrough. This single action keyed great interest in Washington. Congressional committees were intrigued with the success and the prospect that the helicopter really provided an antitank capability.

It should be noted that the Cheyenne expired quiety 2½ months later, within days of the time that its corrected rigid rotor system was successfully flight tested. The Kontum experience provided the vehicle for refining the statement of requirement for the advanced attack of helicopters. In fact, it sold the AAH both in the Pentagon and on Capitol Hill.

Of course, these happy events could not kill forever the interminable questions about helicopter survivability. Doubts always will exist and the true answer will never be known for sure until actual combat provides statistical validation. But Kontum was the watershed. It proved the utility of the helicopter against tanks and it reflected favorably on helicopter survivability.

After Kontum, a general tidying up of the aviation house was in order. The first version of the nap-of-the-earth training manual needed revision. The ability of the helicopter to work and fight around the clock had to be demonstrated. This involved developing night low-level tactics and a tactical instrument program. The training people had to translate concepts into programs of instruction. New gunnery and missile techniques were needed. In short, the whole method of operation for European combat needed refinement. An even bigger job was to readjust the force structure for Europe and to put the TOW missile on the AH-1 Cobra attack helicopter as an interim tank killer until the advanced attack helicopter was produced.

Fundamental to these changes was the need to change the thinking of aviators to the point that they have confidence in their ability to fight and win in heavy combat.

These tasks still are under way throughout the Army. But the hinge was in the early 1970s when aviation turned from proven success in the Vietnam environment to a reorientation to face the heavy threat environment in Europe. A central role for the helicopter in Europe is now assured and should prove that the best days of Army aviation are still to come.

All of which shows that the clever guy doesn't just live with success. He builds on it.

Captain Ford Allcorn flies his L-4 Grasshopper from the *USS Ranger* during the North African invasion

Army Aviation Logistics *In Evolution*, 1942-1953

Part 1

Laurence B. Epstein
Chief, Historical Division
Troop Support and Aviation Materiel Readiness Command
St. Louis, MO

ARMY AVIATION logistics today is a large, complex and sophisticated matrix of operations, facilities and personnel. It was not always so.

Army aviation was first committed to combat during the North African invasion in November 1942. Three Piper L-4 Grasshoppers were launched from the aircraft carrier *USS Ranger* 60 miles off the Moroccan coast. Naval gunners, startled to see the little aircraft, opened fire on them, as did the Vichy French "enemy" shortly thereafter. Only officially 5 months old, few people were familiar with either the aircraft or their mission.

Earlier, on 6 June 1942, the War Department had established Army aviation by assigning a team of two liaison airplanes to each field artillery battalion and each division, brigade and corps artillery headquarters. Two pilots and a mechanic were assigned to operate each pair of aircraft.

This capped the Field Artillery's struggle over several years to obtain suitable aircraft for the observation and adjustment of artillery fire by aircraft that were owned, operated and maintained by the artillery units in the field. The pilots were Artillery Soldiers who were trained to fly. They were familiar both with Field Artillery's problems and with the gunners whose eyes they became.

Army aviation's debut at Ft. Sill, OK and in combat was made without a firm plan of organization or tactical employment. Unfamiliarity

Mr. W. T. Piper Sr., president of Piper Aircraft Co., prepares for a flight during the Louisiana Maneuvers of 1941

and indifference plagued Army aviation throughout the North African campaign. Many of the Field Artillery commanders did not know what to do with a handful of aviators and light, unarmed aircraft. It was not unusual for an entire Field Artillery battalion to move off in the middle of the night and neglect to inform their assigned aviation section. Frequently, commanders failed to provide for the feeding and supplying of their attached air section personnel.

Few Field Artillery commanders were qualified to evaluate either the operations of their aviation sections or the qualifications of their personnel. As a result, the air sections were usually on their own. That Army aviation survived the North African campaign and prospered was due solely to the ingenuity and exploits of its liaison pilots and mechanics.

Only the Army Air Forces had the fiat to purchase aircraft. The Commanding General of the Army Air Forces was responsible for procuring and issuing to the Army Ground Forces the necessary liaison airplanes under the 1942 Troop Basis. They also supplied the necessary spare parts, repair materiels and auxiliary flying equipment required. He and the Army Ground Forces commander jointly determined the number of aircraft required and their expected delivery rate, the quantities of other aviation supplies and equipment needed, as well as the procedure and policies in regard to their issue and delivery.

Maintenance responsibility was split. The Army Air Forces were to provide major repairs which required the use of base shop facilities, known as third echelon main-

tenance to them. The Army Ground Forces were to handle all maintenance that could be performed in the field with the use of handtools and equipment normally available to field units. In actuality, the Army Air Forces overlooked this responsibility when they organized their overseas maintenance support units. The result was that the Army aviators had to set up their own parts supply system as best they could in the combat zone.

The Field Artillery's aviation liaison sections suffered in North Africa from poor aircraft maintenance and supply procedures. They encountered a host of unanticipated problems in administration, supply and operational employment, in addition to those in maintenance. The manuals and policy statements in which the answers were spelled out had yet to be written. Consequently, the logistics system was very much the result of innovation and informality, instead of preconceived design.

Informality was a hallmark of Army aviation that was to continue throughout the war. It is difficult today to comprehend the informal manner in which Army aviation came into existence. In the summer of 1940, a lieutenant in the Texas National Guard, Joseph McCord Watson Jr., a member of the recently federalized Texas 36th Division, suggested to his commander that a solution to obtaining airplanes to adjust their brigade's artillery fire might be to ask a civilian aircraft company. With his commander's oral permission, LT Watson called the Piper Aircraft Company in Lock Haven, PA to ask if they would be interested in participating in Army maneuvers at Camp Beauregard, LA.

Mr. William Piper Sr., Piper's president, sent a pilot and a Piper Cub. It was to be the first of numerous such occasions. This unpaid support eventually grew into a squadron in which other light aviation aircraft manufacturers also joined. This joint military-industrial cooperation demonstrated, through their participation in a series of maneuvers during the next year, that the use of light, unarmed civilian aircraft was feasible. It led to the official tests that the Chief of the Field Artillery and others had been striving unsuccessfully to obtain.

L-4s on the flight line at Ft. Sill, 1942

Army aviation succeeded because it was a practical solution worked out by practical people. Those who were involved in it were more interested in flying airplanes than desks.

It seemed ludicrous in those early, unproven days to view the L-4 as a weapons system. Most were off-the-shelf Piper Cubs with L-2 Taylorcrafts and L-3 Aeroncas making up the rest. They were found circling little civilian grass strip airports every Sunday. The only differences were that these unarmed, unarmored, single-engined airplanes were painted olive drab and had radios. They were powered by simple 65 to

One of two L-5s located at Luca, Italy, assigned to the 1st Armored Division, in September 1944

70 horsepower engines which any automobile mechanic easily could understand and repair.

Their flight instrumentation consisted of airspeed indicators, nonsensitive altimeters and magnetic compasses. They had no flaps, turn-and-bank indicators, navigational radios or lights (since they were not intended to be flown after sundown). In essence, they were as close to powered gliders as it was possible to get. Also, they were extremely rugged—in spite of their stretched fabric over tubular frame construction—easy to maintain and dependable.

This simplicity was one of the major selling points of the limited program to the War Department. The little aircraft did not use critical resources needed for warplanes and could be maintained in the field. They had a low price tag (a Cub cost $2,400 with radio), inexpensive to maintain and as useful as the ubiquitous jeep.

Many problems encountered by the Artillery pilots had to be solved by improvising and they learned their lessons from experience. But by the end of the North African campaign, a pattern for the employment of Army aviation and its logistical support had taken shape. It was not to change much for the remainder of World War II.

Equally as important, field commanders began to recognize the value of organic light aviation in achieving their objectives and in performing a wide variety of tasks. These included everything from flying commanders quickly from place to place to carrying emergency supplies to isolated units. Later, in Europe, some pilots experimented with lashing bazookas (along with reports of other armament) to the wing struts and were credited with destroying German tanks. By the end of the war, the Army Ground Forces were operating more than 1,000 light, liaison aircraft, all L-4s and L-5 Sentinels, which had been purchased at an overall cost of around $42.2 million. The costs of logistical support and avionics were negligible.

One of the reasons that logistics support and avionics costs were negligible was that avionics practically were nonexistent and logistics primarily were hand to mouth. Pilots and mechanics did much of the maintenance in the field near the front line, and occasionally behind the enemy's lines. They handled their airplanes just as Cavalry troopers had groomed and cared for their horses. Automotive gasoline was a common substitute for high octane

Aeronca L-16s used to train Army and Air Force liaison pilots at San Marcos AFB, TX, 1951. The aviators were taught to take off and land from almost inaccessible areas

L-16 aviator at San Marcos holds his breath as he barely clears landing hurdle

aviation fuel which was often unavailable to them. "Scrounging" became the standard operational procedure.

An L-4 named "Lucy" was an example of the expedient nature of repair and maintenance needed to keep the Field Artillery's liaison airplanes flying. Major Edward S. Gordon logged more than 100 combat missions in "Lucy" by the end of the Sicilian campaign. But "Lucy" was not the same "girl" she had been when she rolled out the doors of the Piper factory at Lock Haven. Incorporated into her airframe was a landing gear made from parts of a German ME-109 fighter and a French bomber. Her instrument panel came from three different American fighter planes (a Lockheed P-38 Lightning, a Bell P-39 Aircobra and a Curtiss P-40 Warhawk) and an armored halftrack. In addition, her glass cockpit housing came from a P-40, some of her tubing came from a French fighter plane and her tail assembly was bench-built from a wrecked jeep.

In March 1943 War Department Training Circular Number 24 made the unit commanders responsible for first and second echelon aircraft maintenance. In addition to being a pilot, the aviation officer assigned to the headquarters battery of division artillery was also the aviation engineering officer. He made the required technical inspections of the airplanes, saw that their technical records were kept up-to-date, and supervised the performance of first and second echelon maintenance. In turn, the senior pilot in each battalion headquarters battery was charged with the maintenance and repair of the airplanes in his section, keeping their prescribed maintenance records, and seeing that fuel, supplies and spare parts were requisitioned.

Army aviation proved itself during World War II with its versatility in performing a variety of functions. The myth that light aircraft could not survive over the battlefield was dispelled, although they fared better with the achievement of air superiority. Thus, by the latter stages of the war, the hostility and indifference to organic light aviation within the Army Ground Forces had all but disappeared. As a result, in August 1945, the War Department extended organic aviation to the Signal Corps, the Tank Destroyer, the Infantry, the Corps of Engineers, Armor and the Transportation Corps.

The cessation of hostilities in Europe and, a few months later, in the Pacific led to a rapid demobilization of the vast armed forces of the United States. Most of the 2,630 liaison pilots and 2,252 mechanics trained during the war were released and the aircraft inventory was reduced from 1,600 aircraft to about 200 before the end of 1945.

The Postwar Period

Army aviation had proven itself to be extremely useful, but it was not a large operation. It was viewed as a concept of observation and liaison. It did not completely displace the role of Army Air Forces in fulfilling part of the same roles when it chose and was able to do so. Without the development of rotary-winged aircraft, Army aviation would have remained only a useful auxiliary. There was no expanded role envisioned for it beyond what had been accomplished during the war.

The passage of the National Security Act of 1947 created the Department of the Air Force and the U.S. Air Force. It made the Air Force an autonomous service co-

equal with the Army and the Navy. The personnel, bases and equipment of the U.S. Army Air Forces were transferred to the new service in a series of 40 orders, the last of which was issued on 22 July 1949.

The Army assumed responsibility for determining the number of and budgeting for the aircraft needed, their accessories and spare parts. The Air Force purchased, stored and issued them at the depot level for the Army. It also continued to perform overhaul and repair work at Air Force depots, and agreed to perform field maintenance in overseas commands until 30 June 1950. Otherwise, the Army performed organizational and field maintenance, except on those Army aircraft assigned to Air Force installations.

Soon after the publication of Joint Army and Air Force Adjustment Regulation 5-1-01 on 20 May 1949, in which fixed wing aircraft were not to exceed 2,500 pounds and rotary wing aircraft were limited to under 4,000 pounds, the Ordnance Corps was assigned the major responsibilities for logistical support of organic Army aviation. It entered the aircraft supply field on 23 March 1950 with the publication of Army Regulation 700-50, "Army Aircraft and Allied Equipment," which was identical to Air Force Regulation 65-70. It prescribed policies and procedures to be followed in the development, procurement, supply and maintenance of Army aircraft and associated aircraft equipment.

Aircraft purchased for the Army could be in any of three categories:

- Those developed by the Air Force in accordance with military specifications and the "Air Force Handbook of Instructions for Aircraft Designers";
- Commercial aircraft purchased without modification after being type certified by the Civil Aeronautics Administration; and
- Commercial aircraft purchased after codification to meet type certification by the CAA and approved by the Air Force.

Associated aircraft equipment was defined as spare parts; maintenance supplies; tools; parachutes; flying clothing; permanently installed navigational and accessory equipment authorized by the Army for the operation and maintenance of Army aircraft. In the case of both aircraft and associated equipment, the Air Force became responsible for preparing specifications, conducting research and development at the Army's request, making type classifications in coordination with the Army, and handling the purchase, acceptance and inspection of them. The Air Force agreed to conduct evaluation and engineering tests as well as service (user) and troop tests of Army aircraft and associated aviation equipment. The Army retained the authority to determine the qualitative and quantitative requirements.

The Air Force agreed to evaluate any recommended modifications of Army aircraft and equipment, as well as handle storage, issue and shipment at the depot level and perform depot maintenance at its own expense. The Army would determine the military characteristics for its aircraft and equipment, approve the specifications, and make the final decisions on the proposed modifications. It would budget for and provide the Air Force with funds for research and development on all items, their purchase, and the expenses incurred in connection with modifications and testing. It also had responsibility for the receipt, storage and issue of its aviation equipment below the depot level, as well as organizational and field level maintenance.

When the Army needed to purchase either aircraft or equipment, it executed a purchase request specifying the type and quantity to be purchased and transmitted it to the Air Force which initiated the purchase order through the Air Materiel Command at Wright-Patterson Air Force Base and its various branch organizations. From that point on, procurement was the same as the Air Force's. Normally, the initial order was a Letter of Intent to the manufacturer, followed by a formal contract when enough production experience warranted the negotiation of definitive prices.

The Korean War

When the North Korean army invaded the Republic of Korea on 6 July 1950, the Army's aircraft inventory had risen from a postwar low of 200 fixed wing aircraft to 725, including 525 two-place liaison aircraft, 143 multipassenger aircraft, and 57 light utility helicopters. No cargo helicopters were in the inventory as yet. Most of the aircraft were worn and obsolete L-5s and L-16s. Few of the newer types were available since the Army, along with other services, was trying to use up surplus World War II stocks in an economy measure under the constricted postwar military budgets. The reality of the situation dictated that Army aviation plans be modest and long-ranged.

The impetus of the Korean War caused a rapid rise in the aircraft inventory to 1,094 aircraft in June 1951 and doubled to 2,053 aircraft a year later. By December 1952, the inventory numbered 1,534 liaison and 320 multiplace fixed wing aircraft, plus 719 helicopters which included 72 cargo types. Besides these 2,573 aircraft, there were an additional 817 fixed wing and 666 helicopters on order.

Army aviation was severely strained in the first year of the conflict. Only 100 of the 1,400 trained aviators in uniform were available for service during the early weeks of the war.

The climate and terrain proved to be more dangerous enemies than the North Korean Air Force. Much of the Korean peninsula consists of serried ranks of hills and jagged peaks whose metal bearing rocks affected the magnetic compasses in airplanes. The worn and obsolete L-5s rapidly deteriorated, imposing

An L-5 prepares to take off for air evacuation operation at 7th Infantry Division airstrip, Tanyang, Korea, January 1951

intense harships on both the aviators and mechanics. The L-5s didn't have any very high frequency (VHF) radios, instrument panels or heaters.

As the fighting moved into the winter months, poor planning resulted in a shortage of cold weather clothing and equipment. Because the airplanes were unheated, the length of time that an aviator could tolerate staying in the air was limited. The mechanics suffered severely as they had to work in the open through the subzero nights to keep the aircraft flyable. The weary aircraft, which suffered constant mechanical failures, were kept in the air only by the "ingenuity and dogged determination" of the ground crews.

Spare parts were nonexistent in the early weeks of the war and all repairs had to be improvised. To add to the difficulties, replacement engines sent from Continental United States (CONUS) were discovered to have been improperly overhauled. A shortage of aviation fuel resulted in a return to the World War II expedient of using truck fuel. In order to alleviate the scarcity of aircraft and spare parts, the decentralized aviation sections were combined at the division level. The shortage of spare parts stocks and the underestimation of maintenance requirements resulted from compiling requirements from data based on peacetime flying hours rather than from data in a hostile environment. It took time before more realistic data could be accumulated in the theater.

Next Month Part II

New Aircraft Types — The Helicopter — Maintenance Problems and Organization

L-4 shared the roads with jeeps and troops during the Korean War

U.S. ARMY

AVIATION STANDARDIZATION

Directorate of Evaluation/Standardization

REPORT TO THE FIELD

DES welcomes your inquiries and requests to focus attention on an area of major importance. Write to us at: Commander, U.S. Army Aviation Center, ATTN: ATZQ-ES, Ft. Rucker, AL 36362; or call us at AUTOVON 558-3617 or commercial 205—255-3617. After duty hours call AUTOVON 558-3166/3167/3168 or commercial 205—255-3166/3167/3168

Checklists: What's Happening?

FOR AS LONG AS any of us can remember there have been Army aircraft checklists. In the "old days" people had their own, stored mentally and retrieved each time an aircraft was preflighted, started, runup, taxied, etc. Since 1969, Department of the Army checklists have been required reading each time an aircraft is flown. As a result, there has been considerable well-meaning discussion about checklists that has produced improvement in them.

Some people have theorized that because we have printed checklists and that they "shall not be memorized" (except for immediate action emergency procedures) there is no need to know anything about the aircraft. The checklist tells it all. That is not necessarily so! As a matter of fact, when we consider that the operators and crewmembers checklist (—CL) is nothing more than a reminder of the actions to be taken, that theory is full of holes. This means that we must know how to operate the aircraft systems in order to respond to the steps in the —CL.

First, we must recognize that the operators and crewmembers —CL does not stand alone. It is an abbreviated version of, and is supported by, the operators manual (—10). The fact is that there are two checklists for each aircraft—the amplified version in the —10 and the abbreviated version in the —CL. This concept allows for descriptive information to be printed in the —10 and not in the —CL.

Have you ever had the feeling that a Munchkin is hidden away in a wilderness cave writing aircraft checklist—never communicating with anyone? Sometimes it may seem that the writer of a checklist, be that person Munchkin or elf, does not know what is going on out in the world, because the reasons for a certain series of checks or the thoughts that went into the product are not always obvious.

Let us dispel the rumor now about the Munchkin (and the elf). A formal joint operating agreement between the U.S. Army Aviation Center, Ft. Rucker, AL and U.S. Army Troop Support and Aviation Materiel Readiness Command makes the Directorate of Evalution and Standardization (DES) at Ft. Rucker the user representative in all matters pertaining to normal and emergency procedures appearing in operators manuals and checklists.

For a number of years, DES has reviewed comments and recommendations received from Army aviators throughout the world (regarding aircraft checklists) in developing and changing checklist procedures. As you might have guessed, there are as many opinions about checklists and their use as there are Army aviators.

Three of the most persistent comments are:

- Too much "how to" information appears in the —CL.
- Aviators are making checks that are not necessary for safe flight.
- Checklists are too long and involved.

A significant number of steps have been taken to improve checklists based on user suggestions. Here are some of them:

Reducing the "how to" in checklists has made them more manageable. The amplified version in the

—10 describes in detail how a check is to be performed while the —CL abbreviated version only reminds the crew that a check is required in a certain sequence and omits the "how to." For example, one step in the —10 normal procedures states: "Engine—Start as follows": and then describes how the start is accomplished in numerous substeps. The same step appears in the —CL but only as "Engine-Start." A star ☆ precedes the —CL step, indicating that the entire detailed procedure appears on the performance section of the —CL. This is an aid to pilots in refreshing their memories (if they desire) prior to pressing the start switch.

Have you UH-1 Huey pilots ever wondered about the voltmeter selector (during runup) and asked, "Is it all necessary?" In the revised —10 and —CL, the check (as it now is) will disappear. The reason? Well, if the VM selector is in the ESS BUS position, the voltmeter indicates the d.c. voltage applied to the essential bus—regardless of the source. With the BAT switch on, the voltmeter reads battery voltage until the main generator comes on line; then, main generator voltage is indicated. When the main generator is OFF and the standby generator is supplying power, the voltmeter reflects standby generator voltage. The nonessential bus position is not checked unless the hoist or heated blankets are used. In the new checklist, the switch remains in the ESS BUS position virtually 100 percent of the time and need not be touched.

Consider, too, the two types of starts—external power and battery. As the UH-1D/H checklist is presently written, it appears that the external power start is the primary method. The majority of starts (at places other than Ft. Rucker) use the battery. Then why the difference? The new checklist makes no difference in the two starts except for the position of the battery switch. This one change eliminates five steps. As a matter of fact, in the Before Starting Engine, Starting Engine and Engine Runup procedures alone, there has been a reduction of more than 20 steps.

Many of the checks that, in the past, have instructed the pilot to perform checks "as required" are being eliminated, e.g., use of cockpit and instrument lights; call for taxi or takeoff clearance; donning helmet and gloves; communication check; cruise power set; level-off checks of navigation radios, flight instruments and control frictions, etc. These are examples of actions that do not need a step in a checklist to remind the pilot to do them. If it is too dark to see the instruments, turn on the lights. When it comes time to taxi, request a clearance. If an air traffic control clearance necessitates a change in frequency, change the frequency.

A way of reducing the number of times a pilot must read checklist steps and then respond with an action is to list all of the switches that are located in one general area under one step. How the switches are set is specified in the —10 as substeps under the one major step. In the —CL, only the one abbreviated step is used to cue the pilot that the switches must be set, e.g., "Overhead switches and circuit breakers—Set." The first checklist to use this method was the OH-58 Kiowa.

Copilot duties for aircraft requiring a crew of two or more will be identified by a circle around the checklist step. The C-12 Huron checklist is the first in which designated copilot duties have been identified.

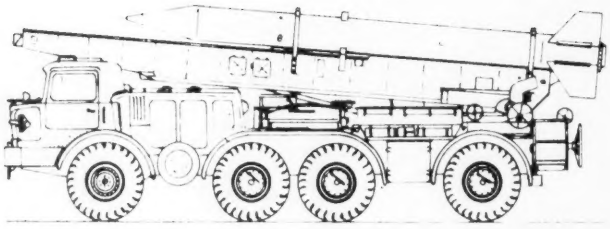
Attempts have been made to ensure that events in emergency procedures follow the same sequence as much as possible for emergencies that are similar in nature. You will note, too, that the techniques used to cope with the emergency appear only in text and not in the steps of the procedure. The details on cyclic, pedal and collective application during touchdown after engine failure are described in text while the —CL procedural step reads only "Land."

Finally, to the aviator (name withheld at request) who suggested an improvement to the —CL by adding a centerfold; it didn't float.

Checklists are improving because of the ideas presented by the users but they are far from being perfect. Sending in your recommended changes on a DA Form 2028 is the best way of guaranteeing continued improvement in these publications.

The C-12 (below), first Army aircraft with a checklist designating copilot duties

THE THREAT:



FROG-7

Description: The FROG-7 is the latest addition to the "Free Rocket Over Ground" family of unguided, spin-stabilized, short-range (battlefield support) artillery rockets. It employs a new transport-launch vehicle, designated ZIL-135, which carries an onboard crane on an eight-wheeled chassis. A similar vehicle is used to transport reserve rockets. The rocket is of conventional single-stage design, with a cylindrical warhead of the same diameter as the rocket body, giving it a clearer, more modern appearance than its predecessors.

Capabilities: The range of the rocket is 60 kilometers (km), and the cruising range of the transporter-erector-launcher vehicle is 500 km. The FROG-7 is capable of delivering high explosive, nuclear or chemical warheads. It may be found in the FROG battalion of Soviet divisions.

Remarks: The FROG-7 first was introduced in 1967 and since has been replacing earlier FROG variants, some of which had been in service since the mid-1950s. The FROG-7 originally was the counterpart of the U.S. Honest John system. The Honest John has since been replaced with the Lance and Pluton missiles. The FROG-7 is to be employed against troop concentrations, logistics support facilities, enemy reserves, helicopter staging areas and targets of opportunity behind the enemy's first echelon forces.

THE HISTORY OF ARMY AVIATION IN HAWAII

LTC Harold B. Richards
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First U.S. Army Headquarters
Fort Meade, MD

ARMY AVIATION in Hawaii? Today? Sure, there is a sizeable amount of Army aviation assets currently assigned to Hawaii's Tropic Lightning Division (25th Infantry Division). But what about 10, 20, 30 or even 40 years ago? When did Army aviation begin in Hawaii? What is the history of Army aviation in Hawaii? If you know the correct answers to these questions, then you are in a minority. But if on the other hand you do not know the answers, then you are in the majority and should enjoy what is to follow.

If you go to Webster's book of definitions, you will find that it defines history as a narrative of events; a chronological record of events. It is not my intent to teach a history lesson, but rather to point out some of the aviation highlights that we in the Army should be familiar with,

South shoreline of island of Maolokai—a scene Major Clark might have seen for the first time on his flight between the islands of Oahu and Maui

proud of, and capable of discussing with a reasonable degree of knowledge. We also should know about some Army aviators who not only made aviation history in Hawaii, but also established many "firsts" for the Army in the Hawaiian Islands.

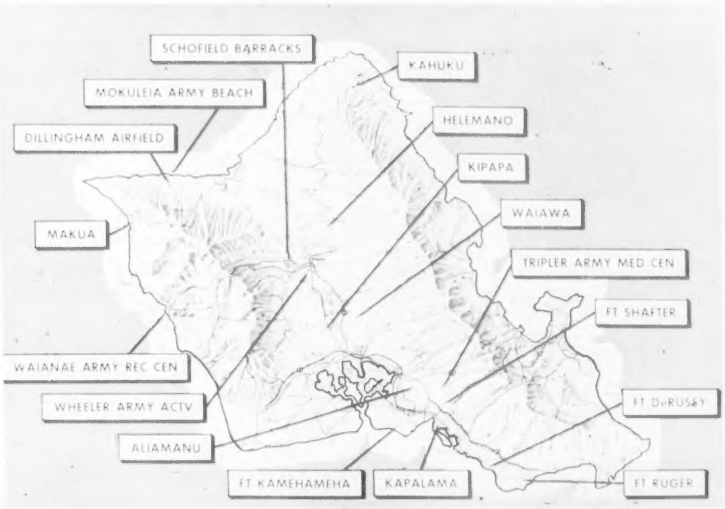
The Beginning. Army aviation in Hawaii really began with the Army's balloon and airship training program located near Omaha, NE. Lieutenant John G. Winter had been detailed by the War Department to aviation duty and was certified as an airship pilot in 1909. On 29 October 1909, Lieutenant Winter's aviation detail came to an end with his return to ground duty. His new assignment was to Troop L, 5th Cavalry, the Hawaii District of the War Department. His interest in flying continued during his assignment in Hawaii and he spent many hours working on a biplane near Leilehua.

Because of his dedicated interest in aviation, Lieutenant Winter was detailed by Brigadier General Macomb, commander of the newly established Hawaiian Department, to be present and observe the first heavier-than-air flight that was to take place in Hawaii. On the afternoon of 31 December 1910, Lieutenant Winter was present when Bud Mars made his historical flight from the polo grounds near Moanalua in a very crude Curtiss P-18 biplane. Lieutenant Winter was never assigned to an aviation position—nor does the record indicate he ever made a flight in Hawaii—but he obviously holds the title as the *first* certified Army aviator stationed in Hawaii.

While these events were happening in Hawaii, the War Department was shifting its concentration in the aviation field from balloons and airships to airplanes. By 20 August 1908, the Wright Brothers were awarded the first Army contract for an airplane. The War Department's interest in aviation was on an upswing and young Army officers continued to be detailed to aviation duty. One such officer, Lieutenant Harold Geiger, was detailed in March 1912, received his airplane rating in September and was officially designated as a military aviator in November.

In January 1913 the War Department selected Lieutenant Geiger to open the first Signal Corps Aviation School at North Island, San Diego, CA. Lieutenant Geiger gained flying experience and the reputation as an outstanding pilot from this assignment. The War Department next assigned him to Hawaii. On 14 July 1913 Lieutenant Geiger, with 12 enlisted men, a civilian aeronautical engineer, and two Curtiss airplanes arrived in Honolulu aboard the transport ***USS Logan.*** Their purpose was to strengthen the defense forces of the First Hawaiian Brigade and conduct testing of the offshore air currents.

Island of Oahu with Wheeler and Schofield Barracks



Ford Island today as seen from southeast. In lower right corner is famous *USS Arizona* memorial

Unfortunately, the organization was short-lived because flying conditions were found unsuitable for the fragile 1913 airplane. All flying was stopped in late November. However, Lieutenant Geiger was the first Army aviator assigned to Hawaii in an aviation capacity.

The First Official Unit. With the exception of exhibition flight, flying in Hawaii was limited for the next couple of years. Concentration on aircraft development and manufacturing was primarily oriented toward Europe and in support of World War I. The potential of the airplane in combat was recognized by the War Department which directed the Army to organize seven aero squadrons. One of the seven aero squadrons was assigned to Hawaii.

The arrival of the aero squadron's first commander, Captain John F. Curry, in Honolulu on 13 February 1917 marked the beginning of the permanent entrenchment of Army aviation in Hawaii. Men and equipment began arriving in late spring and by midsummer, the 6th Aero Squadron was born.

The aero squadron's initial home was at Fort Kamehameha; however, Captain Curry found an island (today known as Ford Island) that would provide a much better site for the 6th Aero Squadron with its N-9 Curtiss seaplanes. After the island was obtained in the fall of 1917, the squadron moved to Ford Island and began construction of hangars, seaplane ramps and troop billeting facilities. The 6th Aero Squadron became the first officially designated Army aviation unit to be assigned to Hawaii by the War Department and Captain Curry was its first commander.

Captain John B. Brooks followed Captain Curry as the commander of the 6th Aero Squadron. Captain Brooks had brought the squadron's men and equipment to Hawaii and served as Captain Curry's assistant. On 22 November 1917 Major Harold M. Clark Jr., was assigned as the new commander of the 6th and the aviation officer for the Hawaiian Department. He immediately began testing the peculiar air currents associated with the valleys leading from the Koolau Range and conducted many flights in the Schofield Barracks area. By the spring of 1918, Major Clark became well known by the population of Oahu for his aviation expertise and especially for his ability to entertain the residents of downtown Honolulu with his low overflights of the city.

Interisland Flight. As World War I was drawing to a close in Europe, aviation support of ground units in combat was established and had confirmed the War Department's earlier decision to develop seven aero squadrons. During the war it

Entrance to Wheeler Air Force Base which has been designated a historical site

was realized that interisland flight by the 6th Aero Squadron would strengthen the military defense structure in the Hawaiian Island chain. Plans were made by Major Clark in late April 1918 to conduct the first interisland flight.

At 0915 on 9 May 1918, Major Clark, along with an aviation mechanic, departed Honolulu in one of the squadron's seaplanes for Hilo located on the Island of Hawaii. The initial flight plan called for an intermediate stop at Lahaina on the Island of Maui but due to unfavorable wind conditions and unstable seas, Major Clark elected to continue the flight and landed in the Kahului Harbor. Army aviation had not only established the first successful interisland flight in Hawaii but it also afforded residents of Kahului, Maui, their first view of an airplane.

The second leg of this historical flight was not quite as successful. Weather was encountered by Major Clark and his mechanic upon their arrival in the vicinity of Hilo and, in an effort to climb over the clouds, they crashed into the Kaiwiki Forest on the slopes of Mauna Kea. Two days elapsed before the two emerged from the rain forest with only minor injuries that were mainly incurred from their treacherous walk out from the accident.

It was later learned that Major Clark had carried with him two letters from Honolulu residents addressed to relatives living in Hilo and, despite the fact that the letters were water soaked from his walk out of the rain forest, he delivered those letters to the parties concerned. This act created another first for Army aviation in Hawaii, that of carrying mail via air between the islands. The Honolulu newspapers headlined Major Clark's accomplishments as setting the pace for future aviation activities in the Hawaiian Island chain.

The End of the Second Decade. The Army's interisland flights between Oahu, Hawaii, Maui, Molokai and Kauai increased appreciably over the 12-month period following Major Clark's historical flight. Fourteen months after Major Clark made his interisland flight, the 6th Aero Squadron officially captured the first airmail flight between the islands with a flight from the newly named Hickam Field to Hilo.

Further expansion of aviation in Hawaii was announced by the War Department in November 1919 when it granted authority to Major General Morton, commanding general, Hawaiian Department, to activate the 2nd Observation Group. This authorization increased the strength for aviation in Hawaii to 47 officers and 344 enlisted personnel. The avi-

ation group consisted of the redesignated 6th Observation Squadron, the 4th Observation Squadron (located at Hazelhurst Field), a photo section and the group headquarters.

Army aviation had more than 150 aircraft located in Hawaii at Luke Field by the end of 1919. The first two decades of the 20th Century saw many firsts for Army aviation in Hawaii and established the foundation for the building of even greater things to come in the next five decades.

The Next Two Decades. Captain Robert Olds continued the trend of Army aviation's firsts with the initial night flight in Hawaii on 30 June 1920.

Some of the firsts in the twenties were not necessarily ones to be proud of. Flight demonstrations or air shows were just as popular then as today. One such air show was given to the International Press Congress at Ford Island on 12 July 1921. Major Sheldon H. Wheeler, commander of Luke Field at Ford Island, was the principal pilot for the demonstration. He was flying an observation biplane for the demonstration when it nose-dived onto the field from an altitude of about 50 feet. Major Wheeler was killed instantly in the crash. Major Wheeler was a West Point graduate, had served with the 25th Infantry Division as a cavalryman, and had enjoyed several aviation assignments during his 6 years as an Army aviator.

Construction of a new airfield began in the spring of 1922 just south of Schofield Barracks and was to meet the increasing needs for facilities to support land planes that were being used by the Hawaiian Department. The field would replace the Hawaiian Divisional Air Service Flying Field at Schofield Barracks that was located on the old 17th Cavalry drill grounds. In honor of the memory of Major Sheldon H. Wheeler—an aviation pioneer in the Pacific—it was designated as Wheeler Field on 3 July 1922.

The Island of Lanai got its first look at an airplane in January 1924 when the Army flew a de Havilland 4-B from Wheeler Field to the island on a hunting expedition. Other flights such as this one continued to show that the use of airplanes on interisland flights were feasible and safe.

The Army Air Service was redesignated as the Army Air Corps in 1926. That same year two Army aviators were flying over Oahu on a training flight when they inadvertently collided. Major Harold Geiger, the first Army aviator assigned to

Wheeler AFB from southeast. On left ridgeline is Kalikole Pass through which the Japanese attacked in 1941

Aerial view of the 1978 lava activity on big island of Hawaii which Army aviation units monitored closely

Hawaii in 1913, gained another first when his aircraft had a midair with one flown by Lieutenant Colonel Hickam. Both parachuted to safety.

The third decade of Army flying in Hawaii was capped off in style. The stage was set with advanced planning by the Army's selection of two aviators and an aircraft that would make the first nonstop flight from the west coast to Hawaii. The pilot, Lieutenant Lester J. Maitland, and the navigator, Lieutenant Albert F. Hegenberger, were to fly a new Fokker trimotor equipped with several new instruments that had been engineered especially for the flight.

The Navy had attempted a mainland-to-Hawaii flight 2 years earlier when Commander John Rogers set out with a crew of four in a PN-9 seaplane. Their flight ended short of Hawaii by about 350 miles. They had to sail the seaplane the remainder of the trip which took 10 days.

Just after 0700 hours on 28 June 1927, a Fokker trimotor christened the *Bird of Paradise* lifted off the airfield at Oakland, CA en route to Hawaii. Because of the Army's extensive planning and the selection of a well qualified crew, the *Bird of Paradise* successfully completed the flight with a landing at Wheeler Field 25 hours and 49 minutes after takeoff from Oakland. Lieutenants Maitland and Hegenberger had set the course for future aviation in Hawaii and had added another event —the first successful nonstop flight from the mainland to the Hawaiian Islands—to the growing list of firsts that Army aviation was compiling. Army aviation had forged the way for transpacific flight and the beginning for many future challenges.

The "Dole Air Derby" was in its final preparations when the *Bird of Paradise* completed its famous flight. The intention of the derby was to encourage civilian interest in conquering the Pacific Ocean with a flight from the mainland to Hawaii. A $25,000 purse would go to the winner. Arthur C. Goebel won the purse when he landed at

Kahulai Airport on Island of Maui

Bradshaw AAF, the only Army airfield in Hawaii

Wheeler Field in his single-engined Travelair Monoplane just 2 months after the Army had completed its flight.

Sir Charles Kingsford-Smith of Australia landed his trimotor Fokker monoplane, the *Southern Cross*, at Wheeler on his flight in 1928 from the mainland to Australia. Seven years later the famous aviatrix, Amelia Earhart, completed the first Hawaii-to-mainland solo flight when she landed her Lockheed Vega at Oakland Airport 18 hours and 15 minutes after departing from Wheeler Field. Built by the Army, Wheeler Field was rapidly becoming the focal point for all aviation in Hawaii.

The 1930s reflected a tremendous buildup of Army Air Corps assets in Hawaii. Such names as Truesdell, LeMay, Twining, McConnell and others were on the rolls of the Army's air units located at Wheeler Field. All of these men and others later became living legends in their own rights while serving their country.

The 1940s were ushered in for Army aviation in Hawaii with the legendary and disastrous Japanese attack on Pearl Harbor. Wheeler Field and its large complement of the Army's aviation assets, were hit hard by the Japanese war planes. The scars of the war can be found today where repairs were made on the ramp and to the several hangars that were damaged.

On 9 March 1942 the War Department created autonomous and coequal commands within the Army: The Army Ground Forces (AGF), Army Air Forces (AAF) and the Army Service Forces (ASF). All elements of the Army's air were incorporated into the AAF under a single commanding general and a single air staff. Because it had been created by law, the Air Corps remained in existence as the chief component of the AAF.

After World War II the U.S. Air Force came into being as part of the National Security Act of 1947—also known as the Key West Agreements. The historically famous Wheeler Army Airfield, that had served as the focal point for aviation in Hawaii for the first four decades of the 20th century, was officially redesignated Wheeler Air Force Base in April 1948.

The Air Force announced the closing of Wheeler Air Force Base 1 year after it had been redesignated. The airfield had been symbolic of the transpacific air transportation's development during the previous 27 years. Wheeler Field was to become history and, for the first time since its commissioning in 1922, would be without airplanes. A formal letter signed by Brigadier General Harold Q. Huglin, USAF, on 21 November 1949, announced disposition of the airfield. Wheeler AFB was placed on the inactive roles in a minimum caretaker status to ensure that structures on the field

Bradshaw AAF with helicopters parked on closed runway. Note blowing dust, which is common occurrance during helicopter operations

25th Division AH-1G Cobra firing in Makua Valley on Oahu

were maintained and preserved from destruction by the elements.

In 1949 the Army requested the use of four buildings that were adjacent to the apron and Runway A at Wheeler AFB. The Air Force approved these facilities as an exception to the closure policy and in the early 1950s a small Army aviation contingency was based at Wheeler in a tenant status.

By mid-1950 an aviation section consisting of observation and liaison aircraft was operating from Wheeler in support of the 25th Infantry Tropic Lightning Division located at Schofield Barracks. This support included the requirement to operate aviation assets at the Pohakuloa Training Area (PTA) on the Island of Hawaii (commonly referred to as the Big Island). The largest training area for the military in Hawaii, PTA is 6,000 feet above sea level. It is located in a saddle area between the two highest mountains in Hawaii, Mauna Kea (13,796 feet) and Mauna Loa (13,677 feet).

Fixed wing aircraft were routinely flown interisland to support the divisional requirements on the Big Island. They used Saddle Road (which paralleled the military training area) as a landing area. Rotary wing aircraft (OH-13s) that were required at PTA were barged the 200 ocean miles from Oahu to the Big Island to reduce the hazards associated with over water flight.

Because of the Tropic Lightning Division's increased use of PTA on the Big Island, in 1956 divisional engineers were tasked to build a semipermanent base camp. Concurrently, a site was selected just west of the base camp area for an airfield.

Bradshaw Army Airfield. Increasing infantry training requirements of the 25th Division in the mid-fifties placed an added demand on the Tropic Lightning's aviation section. More aircraft were added to the section and new UH-19s were programed to provide a troop-lift capability. The buildup of aircraft was supported with an increase in aviators such as First Lieutenant Gary A. O'Leary who arrived in Hawaii in September 1956.

The influx of new aviators created an additional workload for instructor pilots (IPs). Captain Henry K. Bradshaw was an experienced aviator who had been assigned to the division for a considerable time. He was identified and qualified as an L-19 (0-1) IP to alleviate some of the workload.

The stage was set. On Monday afternoon, 15 October 1956, Captain Bradshaw and Lieutenant O'Leary departed Wheeler on a local orientation flight in an L-19. At 1420 hours a witness reported that the aircraft crashed in a pineapple field near Kawailoa Camp (north of Schofield Barracks). It exploded on impact and both occupants were killed. These were the first aviation fatalities in the division since its return to the Islands in 1954. The division's aviators had accumulated almost 40,000 flight hours in their 25 aircraft over the previous 2 years.

The following spring the division's engineers completed the airstrip for PTA. On 8 April 1957 the United States Army, Pacific, cut General Order Number 26 naming the airfield at PTA as "Bradshaw U.S. Army Airfield" in memory of Captain Bradshaw.

The Last Two Decades. The presence of Army aviation was not absent from Hawaii in the 1960s. One of the first gunnery schools for helicopter crewchiefs was formed in Hawaii under the control of the Tropic Lightning Division. The final

FAA ATC facility for the Pacific located inside the famous Diamond Head Crater. The facility, used by all facets of aviation, is colocated with the Hawaiian Army National Guard units

ABOVE LEFT: Honolulu International Airport as seen from the east. ABOVE: Famous MAST emblem for Hawaii. MAST is one of the most praised assets the Army has in Hawaii. BELOW LEFT: Koko Head on Oahu, the jump-off point for flights to other islands

product was actively sought by all combat aviation units serving in the Republic of Vietnam.

The division, with its aviation resources, left the Islands in the mid-sixties to meet the war threats of Southeast Asia. A small Army aviation element remained in Hawaii after the division's departure to support the United States Army, Pacific, headquarters.

The 1970s called for the return and reactivation of the Tropic Lightning Division into a two infantry brigade concept and conversion of the 161st Aviation Company to the 25th Combat Aviation Battalion. Other aviation units were assigned to Hawaii. The 118th Assault Helicopter Company and the 147th Assault Support Helicopter Company, both combat veterans of the Vietnam War, were attached to the division as corps assets. Finally, the 3rd Squadron, 4th Cavalry, with its organic aviation elements, was assigned to the Tropic Lightning Division to round it out as the Pacific Command reserve.

Army aviation has not been without its first for the 1970s. The Army received authority in 1974 to initiate the Military Assistance to Safety and Traffic (MAST) program on the Island of Oahu. This was another first for Army aviation in Hawaii and has contributed immeasurably to the community relations program.

Army aviation has become an integral part of aviation history in Hawaii. From the first interisland flight in 1918 to the first MAST program in 1974, Army aviation has set the pace for others to follow. Hawaii's number one industry, the tourist trade, may not have developed as fast as it did had it not been for two Army aviator's successful nonstop flight from the mainland to Wheeler Field in 1927. Regardless of the era, Army aviation has been the leader in establishing significant events that later became an important part of "The History of Army Aviation in Hawaii."

BLIND FLYING

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WHILE AVIATORS have been around for 75 years, instrument qualified aviators with access to reliable safe procedures and equipment have not been a part of aviation's total history. Except for airline pilots and a handful of military aviators, instrument flight was a mystery to most of the aviation community prior to World War II.

Some aviation historians might remind me that the Army's Jimmie Doolittle performed flights as early as 1929, during which the operation from takeoff to landing was entirely "under the hood." However, Jimmie was not the average aviator flying the average aircraft of the time. He was an exceptional individual who, with the cooperation of the Daniel Guggenheim Fund for the Promotion of Aeronautics and the U.S. Army, was engaged actively in breaking new ground in the technique of "blind flying" as it was then called.

World War II and the necessity for sustained offensive operations brought to the surface the need for instrument flight capabilities. Consequently, instrument training received increased emphasis in the Army's flight school curriculum and instrument flight equipment was upgraded in short order.

It is interesting to note that the procedure for acquiring an instrument rating in the early years of World War II was to have an instrument checkride administered by *any* aviator who possessed an instrument card. One can well imagine the lack of quality control and the abuses that were prevalent under such a system. I know of more than one occasion where the checkride consisted of an hour or so of acrobatics in an AT-6.

On the other hand, there was no "padding" of instrument flight time during this period, inasmuch as there were no provisions for logging of weather or hood time in the pilot's flight record until 1943. The term "blind flying" still was being used by many aviators of that era, even though "instrument flight" was the officially accepted term. Procedural and equipment improvements came rapidly during the war years. They included radar, loran, VHF communications, instrument landing system, ground controlled approach, radar altimeters and attitude instrument flying.

It was not long after the war that VOR came along, followed by TACAN and DME. The colored airways (Red, Blue, Green and Amber) and the low frequency radio ranges gave way to victor airways and VORs.

Today, we talk about flight directors; category I, II and III landing minimums; zero zero systems; microwave landing systems; laser landing systems; inertial guidance; Doppler; and a myriad of others too numerous to mention. How did we ever arrive at such a state of the art? Well, it wasn't easy, but it might prove interesting to look into.

The first flyer to be involved in an aircraft accident was Icarus when he exceeded operational and design limitations and crashed into the Aegean Sea. History, however, has not recorded the name of the first aviator to have become lost inadvertently in the soup, nor do we know how the aviator coped with the problem or the outcome of the close encounter.

In his 1938 edition of ***Air Navigation,*** Lieutenant Commander P.V.H. Weems, one of the foremost authorities on the subject in the 1930s, devotes a considerable portion of his book to the problems of "blind flying." Here are a few of the more noteworthy excerpts.

> **"Blind Flying.** Blind flying is the term applied in the art of flying and navigating aircraft under those atmospheric conditions where neither the earth nor the sky is visible to the pilot. Such conditions are exemplified by thick fog, dense cloud, snowstorms, and the complete darkness of night, any of which would prevent a pilot from being able to orientate himself in space by reference to any known datum.
>
> "The only methods of navigation applicable to blind flying are dead reckoning and radio posi-

tion finding. It is, therefore, highly desirable for the navigator to become proficient in these methods before attempting to fly blind.

"For blind flying aircraft must carry at least the following navigating instruments and equipment when using dead reckoning and radio position-finding techniques:

- Suitable maps
- Reliable watch
- Magnetic compass
- Turn-and-bank indicator
- Artificial horizon
- Airspeed meter
- Altimeter
- Climb indicator
- Two-way radio"

The chapter on "Instrument Flying" in CAA Bulletin No. 24, September 1940 did not even go that far. "Instrument flying has been defined as flight of aircraft in which visual reference is not continuously available and the attitude of the aircraft and its flight path can be controlled in part or in whole by reference to instruments only.

"For instrument flying, aircraft must carry at least the following navigating instruments:

- Airspeed indicator
- Altimeter
- Magnetic compass
- Bank-and-turn indicator
- Sensitive altimeter
- Rate-of-climb indicator
- Clock with sweep second hand
- Two-way radio"

Today such requirements would be considered inadequate for safe operations under instrument conditions.

The Impossibility Of Blind Flying By Instinct. Before aviators became conversant with such terms as vertigo, spatial disorientation and postural senses (touch, pressure and tension), flying by instruments was considered to be impossible. The 1938 edition of ***Air Navigation*** cites an example of an experience of a British pilot in 1915 describing vividly the sensations and experiences while flying blind without special instruments and without special training for blind flying.

"A huge bank of black clouds loomed ahead. Our orders were to land if clouds were too bad, but as two machines pushed on ahead of me, I pushed on too. It started with a thin mist and then gradually got thicker. It continued so for about 10 minutes and then I found that according to my compass, I had turned completely around and was heading out to sea. The clouds got thicker and the compass became useless, swinging round and round. I was about 7,000 feet up and absolutely lost. The next thing I realized was that my speed indicator had rushed up and the wind was fairly whistling through the wires. I pulled her up, and had quite lost control. I nosedived, stalled, etc., time after time, my speed varying wildly. I did not get out of the clouds until I was only 1,500 feet up. I came out diving headlong for the earth. As soon as I saw the ground, I of course adjusted my sense of balance and flattened out. I was however, hopelessly lost—the sea was no where in sight. I steered by my compass (which had recovered, being out of the clouds) and after a short time picked up the coast."

A highly dramatic description of the problems and pitfalls associated with blind flying is given by Donald Kehoe in his book ***Flying With Lindbergh,*** which is excerpted by Commander Weems in ***Air Navigation:***

"I could almost see the cockpit of the "Spirit of St. Louis," and watch Lindbergh's eyes as they passed quickly but methodically from one instrument to another. Only by his perfect under-

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standing of that set of instruments before him, and his calm vigilance in reading them correctly, could he win that battle with the elements.

"It would almost be the same as the fight he had waged with the fog on the transatlantic flight. From the compass which kept him on his course, his eyes would have to go on rapidly to the bank-and-turn indicator. This would tell him whether he was flying straight or turning, and how steeply the wings of his ship were inclined, if he was not in level flight. Next, to the altimeter, so that he would not get dangerously close to the ground. With this, he must coordinate his knowledge of the particular terrain below, remembering whether it was rising or not, so that the sea-level altimeter would not betray him through a false sense of security.

"From the altimeter his glance would have to go to the engine tachometer and the air-speed meter, so that he would be warned if the plane was climbing or diving, the first of which might lead him to a stall, the other perhaps to destruction if it were not quickly corrected.

"At intervals his eyes would have to pass on to the clock, so that he could estimate the distance to be checked off his map. Without this method of locating himself approximately, he would indeed be lost. When he could find a spare second, he would shoot a swift glance at the oil pressure and temperature gauges. Thus, the cycle would end—to begin again, at once. And this must go on, over and over, until the grudging fog gave up and showed him the land below.

"All of this while he hurtled along at almost a hundred miles an hour!

"Blind flying such as this is the supreme test of any pilot. Some cannot stand this rapid movement above a hidden world, nor the haunting fear that they may have calculated erroneously and may be about to crash into some unseen obstacle. Sometimes their senses tell them that the instruments are wrong. They break under the strain imposed by their lack of confidence in their ability and realization of their own weakness. In desperation they climb up higher in the effort to pull out of the enshrouding fog, sometimes reaching clear air only at high altitude. At this height, they cruise along miserably, afraid to come back through the mists, wondering where they are, and tortured by the knowledge that their gas is being used up and they soon must plunge back into that terrifying realm of blindness.

"Or else they dive down with the hope of finding a clear spot close to the ground, where they can make a forced landing. Sometimes they succeed, but sometimes disaster comes without warning as the earth appears through the fog too late to avoid a crash.

"Panic is fatal in this kind of flying. Only the man with utmost calmness and perfect understanding of his instruments can keep it up hour after hour . . . ."

The mystique surrounding the art of instrument flight continued for many years. Early attempts at in-

"All of this while he hurtled along at almost 100 miles an hour!"

strumentation resulted in providing the aviator with an estimate of the situation; not the definitive data required for safe and accurate instrument flight. The first altimeters were crude aneroid barometers and did not compensate properly for temperature and pressure changes. At best, these altimeters indicated an approximate altitude.

An attempt at providing pitch and bank information was the development of the inclinometer. Unfortunately, this instrument merely indicated the direction of apparent gravity (the resultant of the force of gravity and any accelerating forces). Consequently, the inclinometer was accurate only when there were no accelerations about the various axes. The magnetic compass was the only instrument that indicated that the aircraft was turning.

The inherent problem of these early turn indicators finally was solved with the development of the turn-and-bank indicator, commonly called the needle and ball. This was a gyroscopically operated instrument that furnished the aviator with reliable bank and turn information. Aircraft control under instrument conditions was now possible, and in the early thirties the 1-2-3 system of aircraft control was introduced. The Army taught this system in its flight training schools, but called it the needle-ball-airspeed method of aircraft control. This was typical of the instrument training I received in 1942.

Essentially, the method involved centering the needle with the rudders, the ball with the ailerons, and controlling the airspeed with the elevators. By today's standards this system was mechanical and uncoordinated.

Just as the turn-and-bank indicator made instrument flight possible, the development of the artificial horizon or gyro horizon and the directional gyro made instrument flight practical. The development of the pitot static system, improved accuracy of the airspeed indicator, introduction of the sensitive altimeter and the vertical speed indicator (formerly called the rate-of-climb indicator), and the use of autopilot (Sperry Gyropilot, for example) made aircraft control during instrument flight pleasurable as well as practical.

To put the reader into the proper historical perspective, Franklin Delano Roosevelt was in his first year of office as the President of the United States at this time. All of these instruments for aircraft control were used by Lindbergh and his wife on their flight across the south Atlantic from Dakar on the west coast of Africa to Natal on the east coast of South America on 6 December 1933. Although there have been refinements, no new instruments for aircraft control have been developed from that time on.

While instrumentation for aircraft control under instrument conditions was being developed and improved, experimentation in methods of navigation under these conditions was being pursued. True, aviation was still "flying blind" and would continue to do so until a reliable and accurate system of navigation under all meteorological conditions became available. Let us examine some of the early attempts to improve the reliability and safety of aviation when operations under marginal weather conditions was necessary.

One of the early problem areas was safety and reliability of navigation during night operations. The Federal Government installed a crosscountry system of light beacons and emergency airfields to alleviate this problem in the early 1920s. By 1926 this system covered 2,000 miles, and by the end of the decade the coverage was about 10,000 miles. This system of light beacons was the forerunner of the modern airways structure in existence today.

Each beacon light was identified by a light flashing the appropriate Morse Code signal. The lights were installed in series of 10, each light having its own Morse identifier. As an example, light number 6 was always — • — (K), and because of the series structure, the same could be said of light numbers 16 and 26. Each series (lights 1 through 10) was identified by the Morse Code signals for W, U, V, H, R, K, D, B, G and M. The location of each beacon light was plotted on the sectional and regional charts then in use, and identified by the appropriate Morse Code signal. About six lights were established to each block of 100 miles. These light lines were still in use on federal airways during World War II. The method used to remember the light sequence was to memorize the short sentence: **W**hen **U**ndertaking **V**ery **H**ard **R**outes **K**eep **D**irection **B**y **G**ood **M**ethods.

In the early 1920s, there was considerable activity in the field of radio navigation. Some of the equipment developed in these early years was quite primitive; in some instances downright comical by our present day standards.

One system certain to bring chuckles today was the rotating beacon stations used in England. It consisted of a continuous wave transmitter that radiated its signal from a loop aerial which rotated once a minute or 6 degrees per second. When using a loop aerial, the signal is strongest in the plane of the loop, and weakest or nonexistent at right angles to that plane; commonly called the null position. Maximum signal strength is difficult to discern for the average observer, but the null position is generally identified with ease, and in this instance, it is used in determining true bearing from the station.

It worked this way: As the loop rotates once a minute, transmission is interrupted while a special signal indicates that the null is approaching north. When the signal indicates north, the observer takes a reading of the sweep second hand of a clock/watch, and another reading at the instant of the null. Let us say the elapsed time is 11 seconds; we know

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the loop rotates at 6 degrees per second, then 6 by 11 = 66 degrees; and the observer's bearing from the beacon is 66 degrees.

While it is true that two bearings for each rotation are possible, one can be ruled out by application of the observer's dead reckoning position. Furthermore, a second station, similar to the first is incorporated in the system, permitting the aviator to take two bearings, thereby giving a fix. Four cycles of transmission are made by the first station. Then there is a pause, during which time the other beacon is in operation.

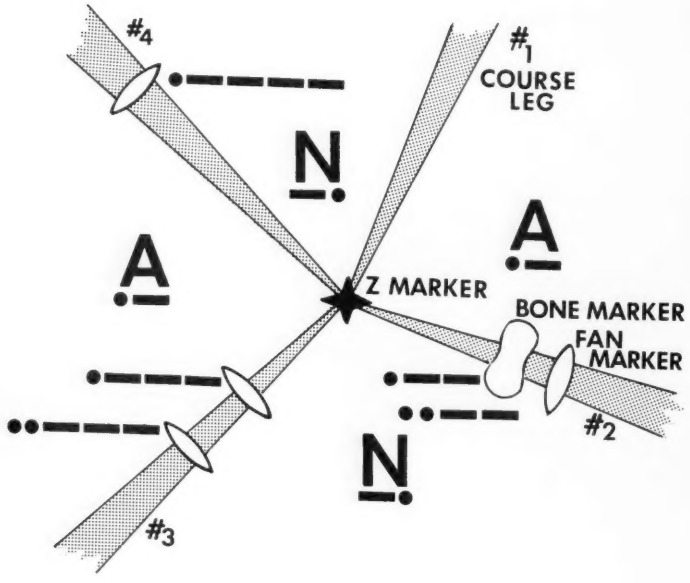
There were too many deficiencies in this system to survive the test of time and practicality. This was a complicated, costly, time-consuming procedure which allowed aviators the opportunity to determine their position, but it did not give them, while en route, the information necessary for a safe instrument approach.

The concept eventually was abandoned. The directional qualities of the loop aerial eventually were incorporated into direction-finding equipment and the radio compass.

Perhaps the greatest impact on safe instrument flight was the development of the radio range in the 1920s. The radio-range station develops four courses, or equisignal zones, by transmitting two characteristic overlapping figure-eight patterns. The Morse signal N (— —•) is transmitted into two diagonally opposite quadrants, and into the other pair of quadrants the signal A (•— —) is transmitted. Each quadrant slightly overlaps the neighboring quadrants, and in the wedge formed by the overlap the two signals are heard with equal intensity—the dots and dashes of the two signals interlocking to produce a solid aural tone. The on-course (equisignal) zone is about 3 degrees in width (figure 1).

Figure 1

Typical radio range station signal pattern

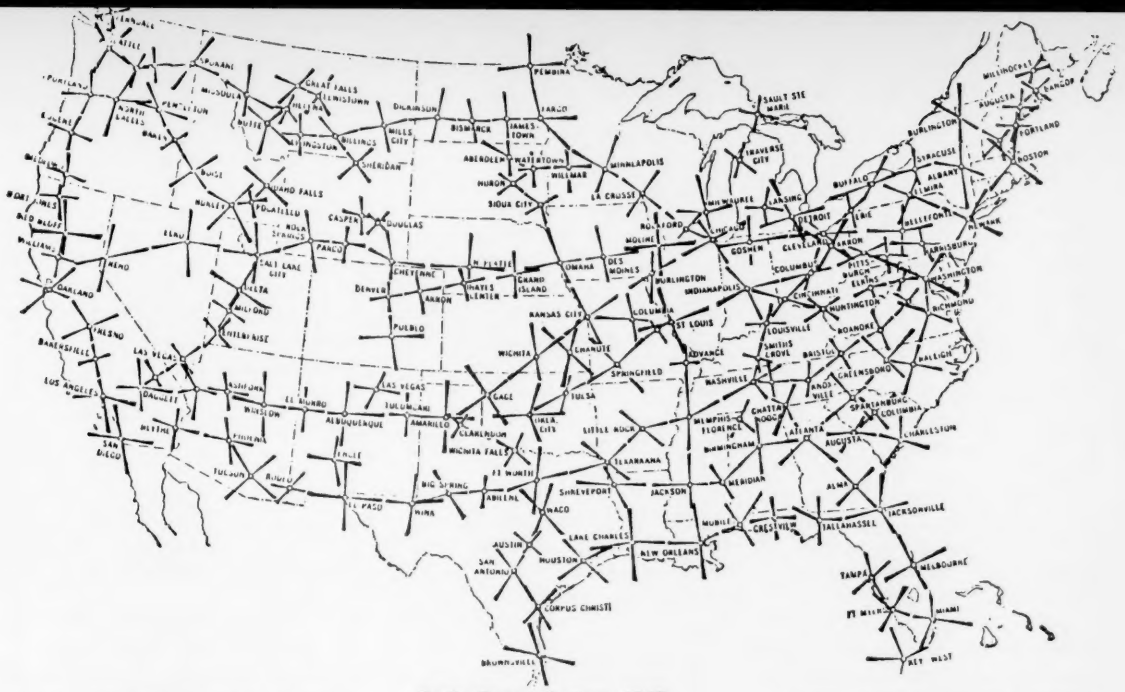


To further assist the pilot in flying the range, marker beacons are installed. Fan markers (bone shaped and elliptical) are coded to indicate the leg they serve and their numerical position on the leg from the station. Legs are numbered clockwise starting with the number-one leg in the northeast quadrant. "Z" markers or station locators also are used to indicate the station passage and the cone of silence. The cone of silence is directly over the radio-range station. It can be recognized by a sharp increase in signal strength, followed by a complete fade in signal while in the cone. This is followed by another increase in signal strength and subsequent fade as the aircraft proceeds from the station.

The marker beacons are used for air traffic control, but they also identify the range course as previously noted, and the aviator's position on

Glossary

ADF	**automatic direction finder**
AGL	**above ground level**
ATC	**air traffic control**
CAA	**Civil Aeronautics Administration**
cps	**cycles per second**
DME	**distance measuring equipment**
FLIPs	**flight information publications**
GCA	**ground controlled approach**
IFR	**instrument flight rules**
ILS	**instrument landing systems**
LOP	**line of position**
MANs	**military aviation notices**
mc	**megacycle**
NDB	**nondirectional radio beacon**
SIDs	**standard instrument departures**
TACAN	**tactical air navigation**
TERPS	**terminal instrument procedures**
VHF	**very high frequency**
VOR	**VHF omnidirectional range**
VORTAC	**VHF omnidirectional range tactical air navigation**



Radio Range System, 1940
Figure 2

that course. The marker beacons transmit on 75 mc and the marker beacon light is energized when flying through the signal pattern. A 3,000-cycle tone also is audible while flying through the signal pattern.

It was the radio range that made possible the nationwide system of airways that are in use today. The range made scheduled airline operations possible, IFR flight planning routine and safe approaches under instrument conditions a reality. True, the minimum weather conditions allowed for an approach in those days were elevated by today's standards, but the pattern had been set for daily, sustained operations. The CAA installed the first loop radio range with scheduled weather broadcasts in 1927. However, the loop range had some unsatisfactory characteristics. The fluctuation of the Heaviside Layer (today we refer to it as the ionosphere) at night produced sky waves, which caused split or multiple beams and false builds or fades. Movement of the antenna by gusty winds caused the courses to move or swing.

The original loop range did not have simultaneous voice transmitting capabilities. In order to transmit instructions or weather information the range was cut off while the information was transmitted. Because the continuous carrier wave was interrupted by the keying device as it sent out the N signal over the N antenna and the A signal over the A antenna, the loop range produced unsatisfactory indications when used for ADF.

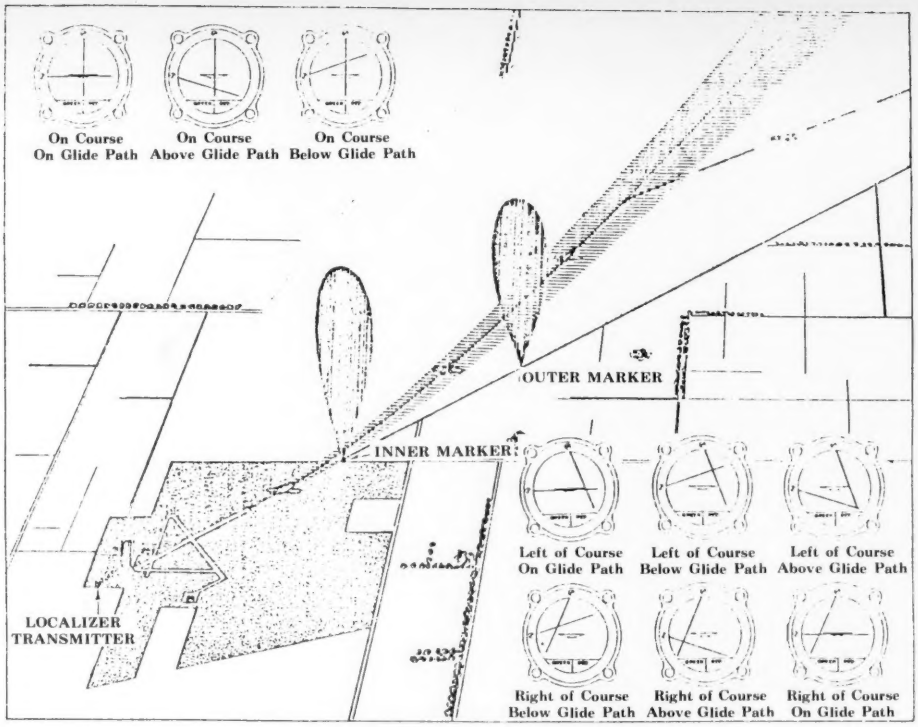
The Adcock Range was developed to correct the disadvantages of the loop range. It was a big improvement and eliminated or reduced most of the unsatisfactory characteristics caused by the design of the loop range. By 1940, radio ranges (Loope and Adcock) covered the Continental United States (figure 2).

Radio ranges remained a part of the Federal Airways System for decades. I recall making a radio range instrument approach to the Albany, GA Municipal Airport in the early 1960s.

A common misconception among many aviators involves the history of the ILS; it is not the recent development some believe it to be. World War II Boeing B-29 bombers were equipped with ILS receivers in 1944, while the first operational ILS ground equipment in the U.S. was installed at Indianapolis, IN, in early 1940.

An even earlier system developed by Lorenz in Germany was probably the pioneer operational ILS system. The Lorenz system was used in England and on the continent of Europe in the 1930s. It consisted of short-wave beacons that provided guidance in the horizontal and vertical planes, and two marker beacons to indicate distance from the landing runway. Sounds familar, doesn't it? The main beacon, which is situated at the far end of the landing runway consists of a transmitter radiating from a central vertical dipole aerial and two similar aerials on either side. Without going into a technical description, this arrangement resulted in loud dashes being transmitted on one side of the approach path, loud dots on the other side, and a steady aural tone while on course.

When the aircraft is flying along the equisignal track, indications of distance from the airport are given by two marker beacons. One of these is about 2 miles from the airport, and the other a few hundred yards from the boundary. The aircraft approaches the first marker at a standard height (about 500 feet AGL). On passing this outer marker, which is indicated by dashes of low-pitched tone, the glide indicator is



Indianapolis Instrument Landing System

Figure 3

adjusted to the center of its scale, the throttles reduced and the aircraft attitude adjusted to maintain the glide indicator on its central reading until touchdown. Just before landing, the inner marker beacon which gives a series of dots of high-pitched tone is heard. This indicates to the pilot that the aircraft is just about to pass over the airport boundary. Crude, yes; not the ILS that we know today, but ILS it was more than 40 years ago.

The ILS we know today is basically the same as the experimental Indianapolis Airport System introduced in February 1940 (figure 3). The system included four fundamental elements: a runway localizer, a glide path, and two vertical marker beacons (an outer and inner marker). A set of controlled approach lights were operated in conjunction with the ILS at Indianapolis, but they were used to supplement the ILS and were not considered a component of the system as they are today. Differences between the 1940 and the present systems that may be of interest to today's aviator involved the marker beacons, the color scheme used in the cockpit instrumentation and approach charts, and the glide path.

In contrast to today's distance of 4 to 7 miles, the outer marker was positioned only 2 miles from the airport and intercepted the glide path at a point where it was a mere 510 feet above the ground. Otherwise, it was the same in all respects to the present day outmarker. It transmitted on 75 mc, was modulated at 400 cycles per second to cause the purple light (on aircraft so equipped) on the instrument panel to flash at the rate of two dashes per second while at the same time an audible signal was recived by the pilot.

The 1940 Indianapolis inner marker was situated at the airfield boundary (which is still true of some present-day inner markers) and intercepted the glide path at the very low altitude of 45 feet. This marker had characteristics that can be found in today's middle marker (75 mc, 1,300 cps and amber light) and today's inner marker (75 mc and 6 dots per second).

The 1940 color scheme in the cockpit display of the ILS and the approach chart used the colors red and green instead of yellow and blue as is the case today.

The method of flying the localizer approach and the interpretation of the instrument indications were the same then as now.

The 1940 glide path and the present glide slope are for all practical purposes one and the same. The method of display in the cockpit and the procedure to remain in the equisignal zone were the same. The glide path of the 1940 system was 3 to 4 degrees; the current system employs a 2- to 4-degree range for the glide slope. The 1940 glide path intercept procedure was necessarily different in that the intercept was accomplished well outside the outer marker. The recommended altitude

was 1,500 feet AGL, and intercept was anticipated when the horizontal needle moved off its full upward deflection. A study of the approach chart (figure 4) indicates that locators were not used with the markers and neither approach control nor radar was available, not having been developed at this time. The ILS and radio range approach were under the control of Indianapolis Radio.

There were of course other refinements to air navigation during World War II and the late 1940s. Long-range navigation was simplified by the development of loran. A skilled operator could compute a fix with accuracy within half a mile from stations 1,500 miles away. The loran receiver enabled the operator to measure the time, in microseconds, required for a radio signal to go from a Master Station to a Slave Station and return to the operator. By using a special loran navigational chart, the navigator converted the microsecond reading to a line of position (LOP). An LOP obtained from another pair of loran stations would give the navigator a fix.

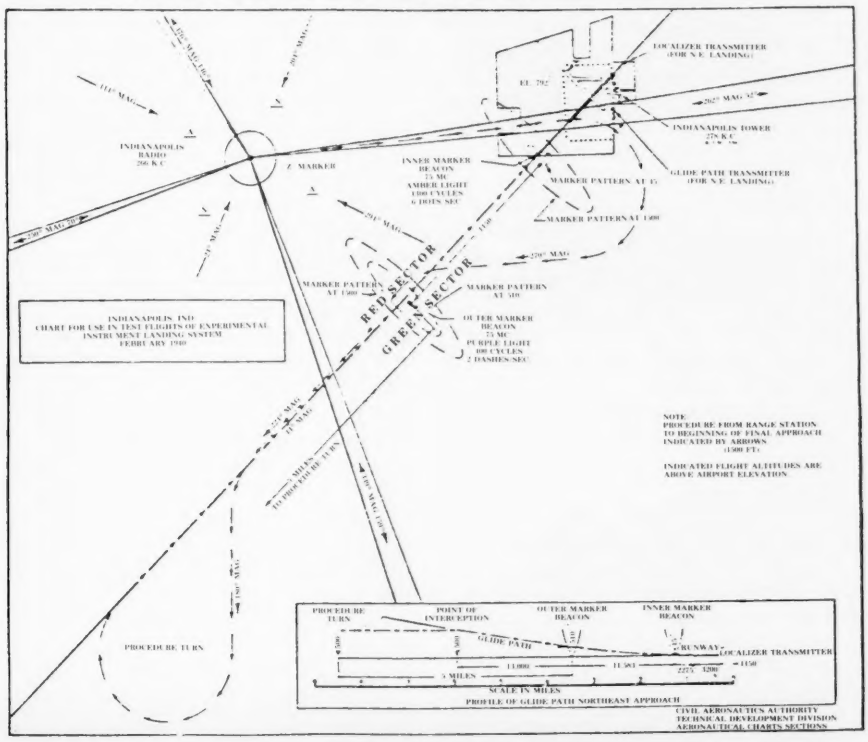
The World War II loran receivers were primitive laboratory models that were hurriedly put into production. The operator was required to go through seven tuning steps in order to get a reading to convert into an LOP. Today's loran receivers are far more advanced, and some are able to give the navigator continuous readings of pretuned pairs of stations. Airborne radar, developed for bombing under instrument conditions, also was used for navigation and position finding. With further refinements, radar gave us the GCA and ultimately became the predominant part of our ATC structure.

Today our airways system is saturated with VORs, VORTACs, TACANs, DME and NDBs. We have airport control areas, approach control centers, control areas, control zones, continental control areas, positive control areas, flight service stations, etc, etc, etc. There are TERPS, FLIPs, MANS, SIDs, high altitude charts and low altitude charts. We have contact approaches, circling approaches, straight-in approaches, tactical approaches, even simultaneous approaches, and sidestep maneuvers. We could go on and on listing all that we have and all that we do for safe flight under instrument meteorological conditions.

Yes, we have come a long way. The U.S. Army can be proud of the very significant part it played in the development of safe air operations under all weather conditions. For myself, it has been interesting to have been a witness to some of that history.

Figure 4

Chart used in test flights of Indianapolis Instrument Landing System



U.S. ARMY SAFETY CENTER

adapted from AEROSPACE SAFETY

A pilot's view of disorientation

BEFORE WE BEGIN, a word about the title is in order. For far too long, most available information on spatial disorientation (sometimes called vertigo by the underinformed) has been oriented towards those with a degree in medicine or human psychology. We poor laymen have been swamped with *proprioceptive* sensors and *otolith* organs in the hopeful assumption that a thorough knowledge of the physiology of the human inner ear will enable us to master spatial disorientation. Unfortunately, it just isn't so.

What is needed, then, is *pilot-oriented* information. Of course, there is still a valid question—will *pilot-oriented* information help us to master spatial disorientation? I believe the answer is yes, provided the information is correct and presented in words and concepts that pilots can understand. That is what this article will attempt to do.

Let's begin by saying that the conscious mind continuously determines its orientation in space by sampling two sources of information—visual cues (which come through the eyes), and gravity/inertia cues (which come from muscle sensors and the balance organs in the ear). Admittedly this represents an over-simplification and physiologists will cringe—but it is a totally adequate description. Let us go on to say that the brain, when sampling gravity/inertial cues, has no adequate way of determining whether the cue results from gravity or inertia without the visual cue as a discriminating input. Further, if the brain is receiving only one cue, it will make its determination of the body's spatial orientation by considering only that cue; that is, although inputs from all cues are required to accurately indicate the body's orientation, not all cues are required by the brain to perform that function.

As long as a person walks on the surface of the earth, there is seldom a problem. The gravity/inertia cue results from gravity, the brain correctly perceives this, and down is down. No corroborating cue from the eyes is necessary. Place this person in the cockpit or cabin of an aircraft, however, and things change drastically.

Down is no longer down in the sense "towards the center of the earth." Instead "down," to the gravity/inertia sensors, is in the direction of the resultant positive inertial vector (the G if you will). This presents no difficulty as long as the aircraft is in straight-and-level, upright, unaccelerated flight, since "true down" and "perceived down" are in the same direction. Accelerate the aircraft in any dimension, however, and the potential for disorientation begins. Consider figures 1-4, which show depictions of "down" as perceived by the gravity/inertia sensors. All aircraft are experiencing one positive G.

It is easily seen in these simple cases that the brain is receiving an erroneous orientation cue from the gravity/inertial sensors in figures 2-4. If "spatial disorientation" is the inability of a pilot to correctly determine his positional orientation in three dimensional space, are the pilots in figures 2-4 spatially disoriented? The answer to that question depends on what these pilots' eyes are doing. If the weather is VFR, and the pilots are looking outside, and if they can see the natural horizon, then they will not be disoriented. Although the brain is receiving erroneous cues from the gravity/inertia sensors, it is receiving correct cues from the visual sensors (eyes). The brain has learned through long experience that the eyes are very reliable in their inputs, and the brain will resolve this conflict in favor of the visual cues.

The clever reader is now asking a pertinent question. If this conflict resolution in favor of the eyes occurs, and if the eyes are reliable in their input, then how can anyone who isn't blind be spatially disoriented?

Fortunately, the answer to this right and proper question is contained within the question itself, and the answer is in three parts:

1. The eyes are not necessarily reliable in their inputs.

2. A pilot in an IFR environment can become effectively, if not actually, blind.

3. The conflict may not always be resolved in favor of the eyes.

It is helpful to consider each of these points separately, and then to see how they can combine to disorient a pilot.

Anyone who has ever seen an optical illusion, or visited a so-called "anti-gravity" house, can testify that the eyes can be easily deceived. Since aircraft instrument panels are not designed with optical illusions built in, it is tempting to say "so what." The "what" is that the arena of flight is filled with optical illusions. Consider the pilot flying VFR above a sloping cloud bank. Or consider a pilot airborne on a dark night above sparsely populated terrain, when an indistinct horizon results in stars and ground lights blending together. Both of these pilots are flying along in the middle of vast optical illusions. The eyes can be fooled.

Fooled yes, but how can they be "effectively blinded"? This one is easy. Take our pilot, put a large volume of clouds or fog that he must penetrate in front of him, and he will be effectively blinded. Aha, you say! In that event, he will have reference to his flight instruments and will, therefore, *not* be effectively blinded. This is true in the ideal situation—indeed it is what the instrument "scan" or cross-check is all about. But if the pilot is required to shift his attention away from the scan for a few seconds—to refer to an en route chart or approach plate, or to change the frequency on a navigational radio—for the period of time that his attention is diverted, and as far as the visual orientation cue is concerned, *this pilot is effectively blind!* This leads to the third part of the answer to our original question.

Under what kind of circumstances will the brain not believe the cue from the eyes? A simplified schematic of what happens to the mind of our pilot will be helpful in understanding this crucial point. Referring to figure 6, we can see that orientation cues—visual and gravity/inertia—flow into the "decision center" of the brain. Under routine circumstances, such as walking down the street, the cues will agree with each other. The decision center then sends messages to the "control center" ordering muscle signals for whatever type of activity is being performed. In routine affairs, this entire activity is so automatic

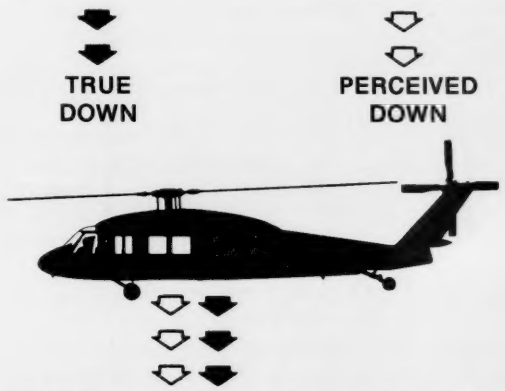


FIGURE 1.—Straight & Level, Unaccelerated

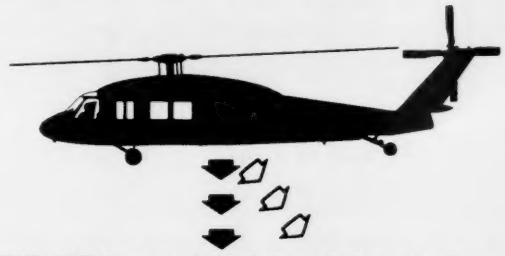


FIGURE 2.—Straight & Level, Accelerating

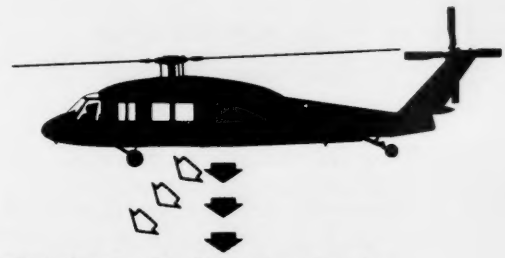


FIGURE 3.—Straight, Decelerating

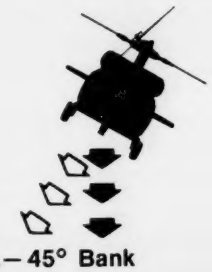


FIGURE 4.—45° Bank

U.S. Army Safety Center—Editor's Note: Over the years, orientation error in Army rotary-wing aircraft has been crucial both in loss of lives and aircraft. Hopefully, this article by Major J. L. Coombes, USAF, will help you better understand what causes pilot disorientation and how to avoid or cope with it. Much of the background information for the article was adapted from a study released by the School of Aerospace Medicine, Brook AFB, TX. Today, with the emphasis being placed on around-the-clock, all-weather capability, disorientation could become a more significant problem. Commanders should insure that aviators receive frequent instrument flight training that provides a realistic environment in which they can become familiar with the conditions and circumstances conducive to disorientation and in which they can learn how to avoid orientation error once they become disoriented.

that it is performed practically subconsciously—like breathing, scratching, or any of hundreds of other movements we make without conscious awareness. (Note that the "decision center" in the schematic has been differentiated to depict the different levels of activity that occur there.)

In nonroutine affairs, and learning to fly an aircraft is certainly nonroutine for normally earthbound homo sapiens, some of this activity must occur at a more conscious level. The more experienced a pilot becomes, the more automatic his responses to requirements for controlling the aircraft will become. In fact, many high-time pilots perform much of the routine of flying as automatically as walking. This is the simple result of vast experience.

Consider, however, a situation where very few pilots have the vast experience required to relegate the decision functions to the automatic mode—IFR flight. In this situation the pilot is performing an artificial, learned task (flying an aircraft) by reference to an artificial, learned, visual orientation reference (aircraft instruments) using artificial, learned rules (FARs, etc.). The second item here, the visual orientation reference, is the item that pilots never practice enough to make it automatic. True, the more it is practiced the more it tends to be automatic. But no one has, or is likely to have, enough actual IFR experience to make this automatic, even if the other two items do become practically second nature.

So here is our situation as we have it developed: Our pilot is flying along in IFR conditions making decisions about his three dimensional orientation in space based on inputs from his visual and his gravity/inertia sensors. Because dependence on the gravity/inertial cues has been a routine part of his life since he was born, he is more-or-less automatically sampling and interpreting these signals. His visual signals, however, are being considered more consciously. He has had to learn how to correlate inputs from an airspeed indicator, an altimeter, a vertical speed indicator, and an artificial horizon. Believing what these instruments tell his eyes about left and right, up and down requires a continuous, conscious effort as long as he

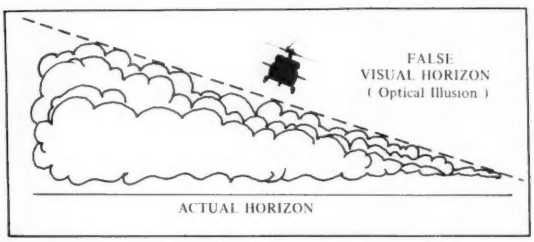


FIGURE 5.—False Optical References Can Lead to Spatial Disorientation

can't see a natural horizon or horizon reference. However, other than a slight increase in respiration, heart rate, and adrenalin flow, nothing very significant has occurred . . . yet. Nothing is likely to happen, either, until a disagreement between the visual cues and the gravity/inertia cues occurs. But when such a disagreement happens, and if our pilot is in IFR conditions it *will eventually happen,* the stage is set for the onset of spatial disorientation.

A typical spatial disorientation encounter might go like this: Our pilot is flying along, straight and level unaccelerated with a normal instrument scan.

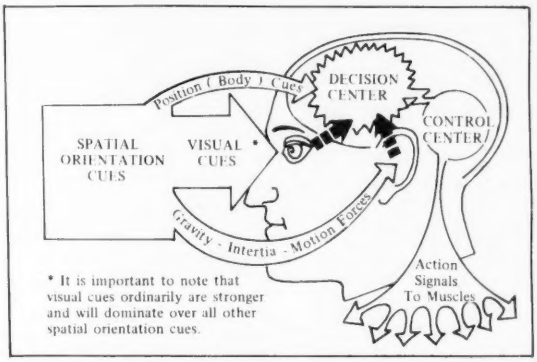

Position (Body) Cues
DECISION CENTER
CONTROL CENTER
SPATIAL ORIENTATION CUES
VISUAL CUES *
Gravity - Inertia - Motion Forces
Action Signals To Muscles
* It is important to note that visual cues ordinarily are stronger and will dominate over all other spatial orientation cues.

FIGURE 6.—The Physiological System of Spatial Orientation

Visual cues from the instrument panel consciously interpreted, and gravity/inertia cues, subconsciously interpreted, agree and everything is fine. Now let's introduce a false gravity/inertia cue. This can occur from aircraft maneuvering, accelerating, pilot head movement, etc. Remember from an earlier point that, without help, the brain cannot tell when the gravity/inertia cue is false. Whatever this signal may be telling the brain, it feels *right.* The perceived down feels like the real down. The visual cue from the instrument panel, however, is telling the pilot what is really happening to his aircraft. The conflict has begun.

The brain is receiving two types of orientation cues that do not agree, and the decision center must determine which cue to act upon. Under normal circumstances, there is still no problem. The decision center will opt in favor of the visual cue, and signals to the control center will be made accordingly. This pilot will, of course, have a nagging feeling of discomfort as long as the two sets of cues are in disagreement, but he will not have uncontrollable spatial disorientation. After the phenomenon that introduced the false gravity cue is "washed out" or terminated, the cues will again be in agreement and everything will be fine.

Suppose, however, that the pilot, in IFR conditions remember, is performing any of a series of maneuvers that are characteristic of an IFR flight plan (climbs, level-offs, descents, procedure turns, etc.), and which induce false gravity cues. While the pilot is trying to rationalize the discrepancy between his cues, his instrument scan is broken by a requirement to retune a navigational radio: *For the period of time that he is looking away from his instruments, his brain's only orientation cue is false.* He is flying an aircraft, however, and his control center requires continuous inputs. The brain, having no choice, begins to send signals from the decision center to the control center based on the erroneous cue. This pilot does not yet have spatial disorientation. His conscious mind is busy with a nav radio, and his subconscious mind is handling orientation matters (albeit incorrectly). There is no conflict between these purposes at this time, and hence no disorientation. The alarming aspect is, however, that the brain is satisfied about its three dimensional orientation based on incorrect information.

Now our pilot looks back at his instruments and attempts to reestablish his scan. At this instant, he will become disoriented. A true conflict within the decision center has begun, and the decision center will grow increasingly frustrated in trying to reestablish the dominance of the visual cue, which it *knows* is correct, over the gravity/inertia cue, which it *feels* is correct. The situation is critical, and, without the reestablishment of visual cue dominance, it may prove to be fatal.

If this pilot is able to force his decision center to believe the visual cue again, he will move back to the previous stage of nagging discomfort until the disparate cues agree. If he is not, he will probably eventually impact the ground with his decision center still locked violently in the conflict struggle. One other possibility exists—he may eventually enter a trance-like state in which the subconscious forces the conscious to cease even considering the correct, but sensorily unacceptable, visual cue. In this event, his mind will be at peace at impact.

This, then, has been an anatomy of a spatial disorientation incident. Granted, there are other types of spatial disorientation. There are situations, such as the rapid eye flicker encountered in nystagmus, where the eyes, though open, are no longer able to send meaningful information to the brain. There are the so-called flicker vertigo incidents encountered by helicopter pilots. There may even be cases of true vertigo, where the gravity/inertia cues from different sensors are in disagreement and, therefore, these no longer "feel" right in the decision center.

But it doesn't matter, really, because spatial disorientation is spatial disorientation. The key to beating it is threefold: *(1) Avoid it, (2) If you can't avoid it, do not lose visual dominance, (3) If you lose visual dominance, get it reestablished as soon as possible.* With these points in mind, the following recommendations will help you to survive the inevitable encounter with spatial disorientation:

1. Be aware of situations that are likely to lead to spatial disorientation encounters.
   - Flying in IFR conditions.
   - Flying on dark nights above sparsely populated terrain.
   - Flying formations on dark nights above sparsely populated terrain.
   - Flying in marginal conditions, especially in and out of cumulus cloud formations.
2. If you encounter the nagging discomfort that indicates the onset of conflict, do not lose visual dominance. Force the conflict to disappear.
   - Practice IFR flight, and your instrument scan, as much as possible. The more experience you have in visually interpeting your instruments, the stronger the links in the decision center relative to this cue will be.
   - Try not to allow the instrument scan to be broken unless the aircraft is in an unaccelerated mode of flight.
   - Keep aircraft maneuvering to a minimum, and make all control inputs smoothly, positively, and at controlled rates.
   - Keep your head movements slow and as smooth as possible.
3. If you have lost visual dominance (the nagging discomfort is getting worse), get it reestablished as soon as possible.
   - Cease maneuvering. Return the aircraft to straight-and-level, unaccelerated flight while you reestablish a firm instrument scan centered on the artificial horizon.
   - If possible, transfer control of the aircraft to another pilot, or an autopilot, if one is aboard the aircraft.
   - Talk aloud to yourself, describing the attitude of the aircraft as indicated by the flight instruments. This will provide an additional correct input to the conscious mind via another route (the auditory nerve).
   - One technique that some pilots find useful is to fly using the cross-cockpit instruments (or standby instruments) for their scan. Increased concentration is required to do this, and is apparently the reason it works for some pilots. One point—try this in practice before trying it in a real situation. The technique may not work for you . . . in fact, it may be counterproductive. If so, scratch it from your repertoire.

Do not fear spatial disorientation—but do not underestimate it either. You *will* have a spatial disorientation incident if you fly in IFR conditions. You can, however, meet it and beat it.

EPMS CORNER

Enlisted Personnel Management System

SFC George L. Alston
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Aircraft Quality Control Supervisor Or Technical Inspector

IN THE ARMY aviation community, there has been some confusion and disparity in the area of aircraft quality control supervisor versus technical inspector since the implementation of the Enlisted Personnel Management System (EPMS). A large number of the members in the community still refer to individuals holding military occupational specialty (MOS) 67W as technical inspectors. The 67W should be referred to and used as an aircraft quality control supervisor.

The confusion arises because, before EPMS, the 67W MOS applied to rotary wing technical inspectors. With the implementation of EPMS, the 67W MOS title was changed to aircraft quality control supervisor and the duties changed accordingly.

In using Soldiers who hold MOS 67W, supervisors and commanders should be aware of the job description under the title *duties* in AR 611-201. If this job description is adhered to, the 67W will not be inspecting aircraft. If the 67Ws are not aircraft inspectors, then what do they do? Their duties as outlined in AR 611-201 are as follows:

- **MOSC 67W30:** Monitors the aircraft quality control program and supervises aircraft technical inspectors. Checks aircraft records to determine adherence to prescribed standards. Computes aircraft weight and balance. Interprets technical publications applicable to inspection and modification. Establishes and maintains the maintenance technical library. Evaluates unit safety programs. Ensures that quality control procedures are adhered to during all phases of maintenance. Estimates man hours, parts and cost required for repair of crash damaged aircraft. Advises aircraft technical inspectors on maintenance practices, procedures and techniques. Ensures that aircraft component replacement schedules are closely monitored and properly complied with. Establishes and maintains technical data and publication files. Checks maintenance and supply documents to ensure compliance with product quality control standards and the Army Maintenance Management System. Performs maintenance trend analyses. Supervises the aircraft configuration control program and the spectrometric analysis program. Ensures compliance in the test measuring/diagnostic equipment calibration and recertification interval schedules. Participates in maintenance assistance/instruction visits.
- **MOSC 67W40:** Supervises aircraft quality control programs and related technical and administrative functions. Prepares evaluation reports of subordinate personnel. Advises the commander on matters pertaining to safety and quality control. Performs maintenance trend analyses. Provides technical guidance to production control and maintenance elements. Participates in maintenance assistance/instruction visits.

If we review the duties, as stated in AR 611-201, of MOS codes 67G, 67V, 67N, 67Y, 67U and 67X at the 30 skill level, we find that Soldiers in these positions are required to be able to perform as technical inspectors as well as maintenance supervisors in their respective MOS. There are many Soldiers at the 30 skill level, in these MOSs, who are exceptionally qualified to perform in this capacity. These Soldiers have been serving as mechanics, crewchiefs, and, in some cases, supervisors up to this level, and they know the aircraft well.

If the 30 skill level Soldiers are working as inspectors, advantage can be taken of the expertise they

continued on page 38

Implications of New Army Aviator Career Pattern

THE APRIL *Aviation Digest* (page 9) briefly discussed major decisions by the Army Chief of Staff to implement a new Army aviator career pattern. These decisions establish the foundation for an aviation management plan that will have a long-term effect on the development of commissioned aviators under OPMS. However, there are still a number of issues and questions to be resolved before the details of the plan are ready for publication as a guide to aviator professional development.

Considerable effort is now ongoing within the Officer Personnel Management Directorate (OPMD), Military Personnel Center (MILPERCEN), to develop the specific training and assignment policies necessary to update the aviation section of Pam 600-3, "Officer Professional Development and Utilization." Further, an internal reorganization within OPMD is underway to provide the management necessary to implement the new career pattern. More details of this reorganization will be published in "Aviator Management" in the next issue of *Aviation Digest.*

This month we need to discuss some of the implications of the recent decision for aviation and the aviator. The major implications are summarized below.

• Although these initiatives apply to our entire aviator force, they will not of themselves disrupt the career development plans of our senior captains and field grade aviators. For some time to come, overage and shortage aviation year groups will exist in all grades. For instance, during the next few years the number of aviation (Specialty 15) majors will far exceed the aviation positions available to them. This situation simply reinforces the necessity for individual year group management to ensure that aviators who are well-established in their careers are not penalized for past training and management policies.

The full application of the new pattern will pertain to our newer aviators and those who will enter the program in the future. Individual concerns about aviation assignment and professional development opportunities for specific year groups should be discussed with career managers in OPMD.

• Specialty 15 is now a combat arms specialty, aligned with the Infantry, Armor, Field Artillery and Air Defense Artillery combat arms branches. For some time now, tactical doctrine has included aviation elements as full members of the combined arms team, capable of fulfilling a maneuver role and controlling both air and ground forces in combat. Personnel management policies must ensure that aviators are developed accordingly, without imposing the requirement to become "branch" qualified through ground assignments or to hold ground combat arms specialties. Their branch relationship demands a close association with their ground contemporaries and identifies the area in which their air ground tactical expertise is to be concentrated.

But they must be experts first in aviation, capable of meeting not only aviation requirements but providing aviation expertise to other specialty areas. This tactical expertise will be developed in the future through integrated training both in school (officer basic and advanced courses) and in the field, while officers serve in appropriate assignments to meet aviation specialty requirements.

• Within an aviation program that is combat arms oriented, three technical roles will receive separate specialty identity. The maintenance, intelligence and medical specialties

OPMS CORNER continued

require additional technical qualification to support fully the aviation mission. There will be little change in the career patterns for these specialties. Although in the future aviators will not be able to select Signal Corps as their branch, requirements that link Specialty Codes 15 and 25 or 27 still exist and will be filled by aviators who can meet those requirements, regardless of their branch. Next month's article also will include the OPMD management organization for these specialties.

• The decisions are intended to align all the aviation specialties with the dual-track objectives of OPMS. The progression of Aviation Specialty code 15, first from a skill to an advanced specialty, and now to an entry specialty, will eliminate the requirements previously imposed on aviators to develop proficiency in three specialties. The designation of a second specialty will occur for aviators as it does for all officers and will include as one of several factors, field grade utilization opportunity. Dual specialty development is particularly important for aviators, not only to allow career opportunity through all grades, but also to meet Army requirements for aviation expertise in other specialty areas. As we begin training at a steady annual rate and overcome the company grade shortages expected for the next few years, we must achieve some stability and confidence in our aviator career pattern.

• The restrictions previously established for female commissioned aviators will not be affected by the new career patterns. Female officers may hold Specialty 15, but may be branched only into Field Artillery or Air Defense Artillery. Females also may hold Specialty 15M, 71 and 67J and the branches that correspond to those specialties.

• The overall objective of the new initiatives is to provide career opportunity and sound management for Army aviators while meeting force requirements worldwide. The assistance and support of every aviator and every commander are necessary to meet this objective. Implementation will be coordinated by MILPERCEN's Aviation Management Branch, OPMD. Your ideas are welcome.

EPMS CORNER continued

have acquired to this point. While they work as inspectors, they will have the opportunity to be groomed as future quality control supervisors. By using these personnel in this capacity, the Army benefits both from the knowledge they have gained and also will be preparing them for their next skill level.

Many 67Ws are doing the jobs of the inspectors while the inspectors are doing the 67W work. This creates a problem in that the 67Ws have been trained in quality control procedures and are not using this training. Many of them are junior grade and if they are not used in the area for which they have been trained, they cannot sharpen their skills for the next skill level.

Some commanders and supervisors feel that some of the 67Ws are not qualified to serve as quality control supervisors. But, if they review the duties of the 67W, they will find that while these Soldiers may not be experts when performing as inspectors in that they cannot inspect an aircraft and find every deficiency, they are proficient enough in the principles of inspecting to perform well as quality control supervisors (67W).

The complaints of a shortage of 67W personnel are unfounded. If the authorization documents, MTOE and TDA are adjusted in accordance with EPMS, and the 67W and 30 skill level personnel are properly used, it will be found that there is an adequate number of Soldiers available for these two functions.

Army photo by Lee R. Jenkins

Gunnery Manual Tested

Craig Strawther
101st Airborne Division (Air Assault)
Fort Campbell, KY

THE 229TH ATTACK Helicopter Battalion, 101st Airborne Division (Air Assault) at Ft. Campbell, KY has been chosen to test the new field manual (FM 17-40) governing gunnery training for AH-1 Cobra helicopters.

The test is designed to validate certain requirements specified in the manual, such as ammunition allocations, exposure time and scoring criteria. For example, the manual specifies that the pilot's exposure time for delivery of the 2.75 inch aerial rocket is 30 seconds. In this instance, exposure time refers to the moment that intervisibility with the target occurs during unmasking until intervisibility is terminated during remasking.

Pilots of the 229th must accomplish this mission within the specified amount of time, using a designated amount of ammunition. If the criteria in the FM proves correct, it will standardize the gunnery training for all attack helicopter pilots in the Army. It also will give battalion commanders a "measuring stick" for determining the proficiency of their units.

The 229th battalion is integrating the validation testing with its annual pilot qualifications.

In addition to testing thhe manual's guidelines for firing 7.62 miniguns, 40 mm grenade launchers and 2.75 inch rockets, the unit will be testing new guidelines for the new Enhanced Cobra Armament System which features turret mounted 20 mm cannons.

These new triple-barrel cannons, when mounted on S model Cobras, can swing 110 degrees horizontally and vertically from the center, giving it an advantage over the previously stationary cannons.

PEARL'S

Personal Equipment & Rescue/Survival Lowdown

If you have a question about personal equipment or rescue/survival gear, write Pearl, DARCOM, ATTN: DRCPO-ALSE, POB 209, St. Louis, MO 63166

Food For Thought

One of the first things to think of in a survival situation is to take stock of your available food and water. Estimate the number of days you expect to be on your own. The pick-up time may vary from a few hours to several months, depending on the environment and available rescue facilities in the area. Divide available food into thirds; allow two-thirds for the first half of your estimated time before rescue, and save the remaining one-third for the second half.

If you decide to divide your party, give each person traveling out for help about twice as much food as you give each of those remaining with the aircraft. In this way, the people resting at the aircraft and those walking out will stay in about the same physical condition for about the same length of time, and the safety and rescue prospects of all will be increased.

If you have less than a quart of water daily, avoid dry, starchy and highly flavored foods and meat. Keep in mind that eating increases thirst. Best foods to eat are those with high carbohydrate content, such as hard candy and fruit bars.

Every bit of work requires additional food and water; the less you work, the less food and water you will need.

You can live many days without food if you have water. When water is no problem, drink more than your normal amount to keep fit.

Always be on the lookout for wild foods. Eat off the land whenever possible. Save your rations for emergencies.

Eat regularly, if possible; don't nibble! On limited rations, plan for one good meal daily. Then, sit down and make a feast of it. Two meals a day are preferable, especially if one of them is hot. If you are collecting wild foods, plan a hot meal. Cooking makes the food safer, more digestible and more palatable. The time you spend cooking will give you a good rest period.

Native foods may be more appetizing if they are eaten by themselves. Mixing rations and native foods usually does not pay.

Energy Requirements: You get your requirements from foods which contain:

Carbohydrates. Mostly plant in origin—sugar, starches, cereals and fruits. If your water supply is severely restricted, stick to these foods.

Proteins. Mostly animal in origin—meat, fish, eggs, milk and cheese. Proteins are valuable fuels but their real importance is in maintaining and repairing body tissues. When you eat more of them than you need for maintenance, the extra amount is burned as fuel or converted to storage fat and carbohydrate. Your daily need is 3 ounces under all conditions; hard work does not require more. If your water supply is limited, do not eat large amounts of protein.

Fats. Partly plant—olive and cottonseed oil; partly animal—butter and lard. Except in very small amounts, fats are not essential for human nutrition. Although inefficient in comparison, fats provide more than twice as many calories per unit weight than do protein or carbohydrates. Diets very high in fat cause digestive disturbances and often produce an acid condition (ketosis) that requires added water intake for elimination.

Bang

Bang! This could be the sound you hear the next time you don your oxygen mask and apply oxygen. One pilot actually had a fire inside his oxygen mask. This problem occurred because of lack of training on the part of the individual who cleaned the oxygen mask and lubricated the connection.

However, the individual who cleaned the oxygen mask had never heard that hydrocarbons and oxygen do not mix and can cause an explosion or fire. Most all fuels, greases, oils, etc. are classified as hydrocarbons. Properly trained life support personnel know that hydrocarbons and pure oxygen do not mix. Never apply any hydrocarbons to any connection or mask where you expect oxygen to be used.

Lethal Weapon

The foliage penetrating flare, NSN 1370-00-490-7362, is a valuable aid in assisting you to be rescued in the event of an air crash. The flare also is considered a dangerous weapon at close range. The flare will penetrate half way through a piece of 3/4-inch plywood at 10 feet.

A civilian aircraft was performing touch-and-go landings. The instructor pilot had inadvertently left an armed flare launcher in the aircraft glove compartment. During one of the landings the launcher fell out of the compartment. When the instructor pilot picked up the launcher, it went off. The instructor suffered severe burns over most of his body and the aircraft was destroyed in the crash that followed.

The lesson here is clear. Never arm your flare launcher, even during practice or training with a live flare, unless you actually intend on firing it.

ROID

This sounds like space age lingo, ROID, but it is just another acronym that we should be familiar with. When you are spending your unit's money to acquire items or equipment out of the supply systems, and the item arrives, it may not be complete or it may be

defective. This is when you should be familiar with your SF-364 ROID (Report of Item Discrepancy).

The ROID will assure that your unit receives funds credit for the defective or shortage of equipment. However, in order to expedite processing and assure credit, be sure and include the following information on your ROID form:

- Government Bill of Lading Number
- Shipping Depot
- Complete Requisition Number
- Transportation Control Number

Note: AR-735-11-2 will assist you in completing the ROID form.

Snake Fright

Snake fright is nearly as bad on many of us as snake bite. The snake bite is uncommon unless you step on the snake, or surprise the snake and it is unable to get out of your way.

The snake will avoid you if at all possible, and most are nocturnal in habit. All snakes are cold blooded creatures and must have warmth to manipulate or move their bodies. Remembering this, if you find yourself in a survival situation, be especially watchful in your movement at night during the warm seasons. Snakes are on the move during the warm season and are commonly found on or around rocks or hard surface roads at night. The snakes will seek the warmth of the rock or road surface at night to warm their bodies.

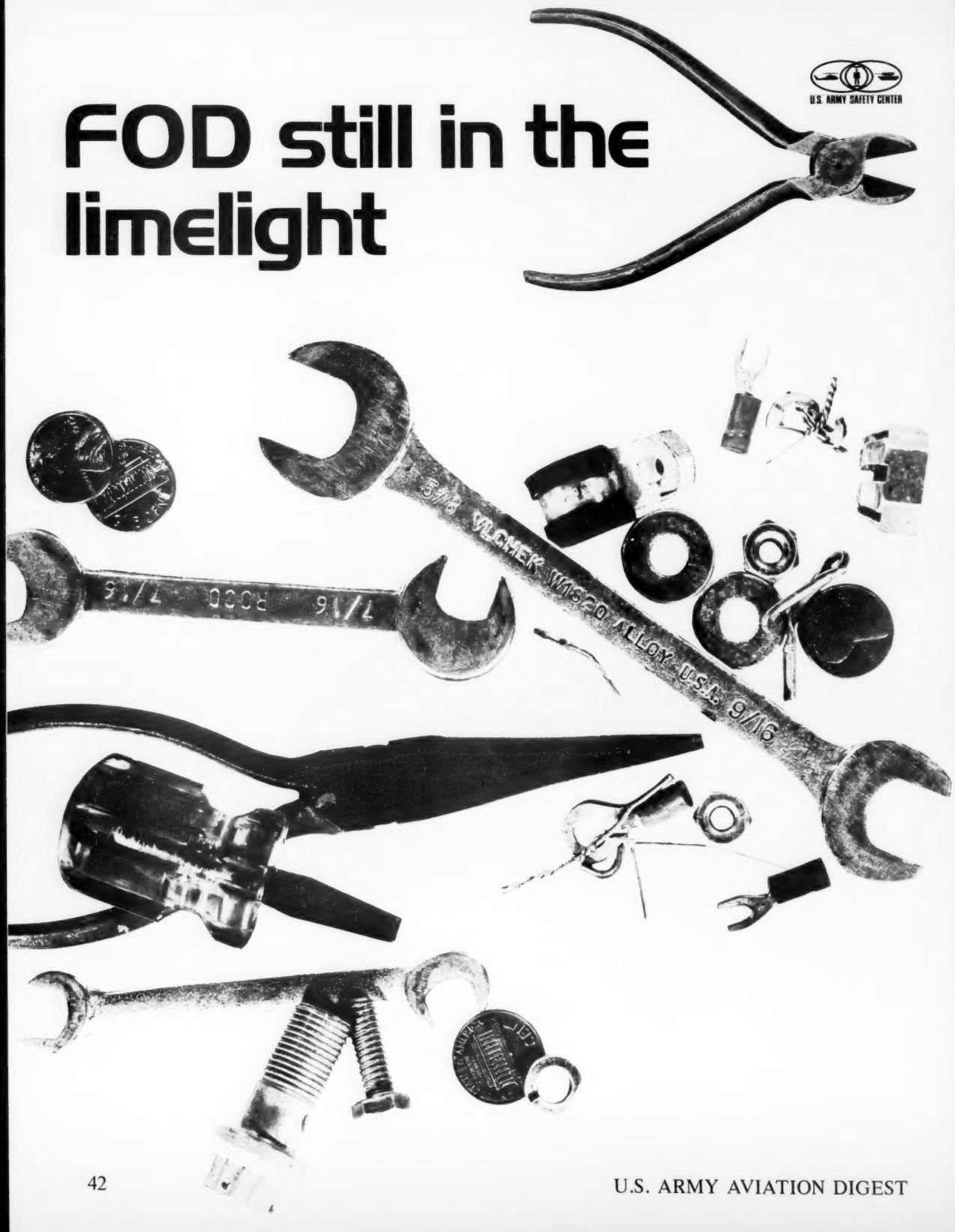
New Number

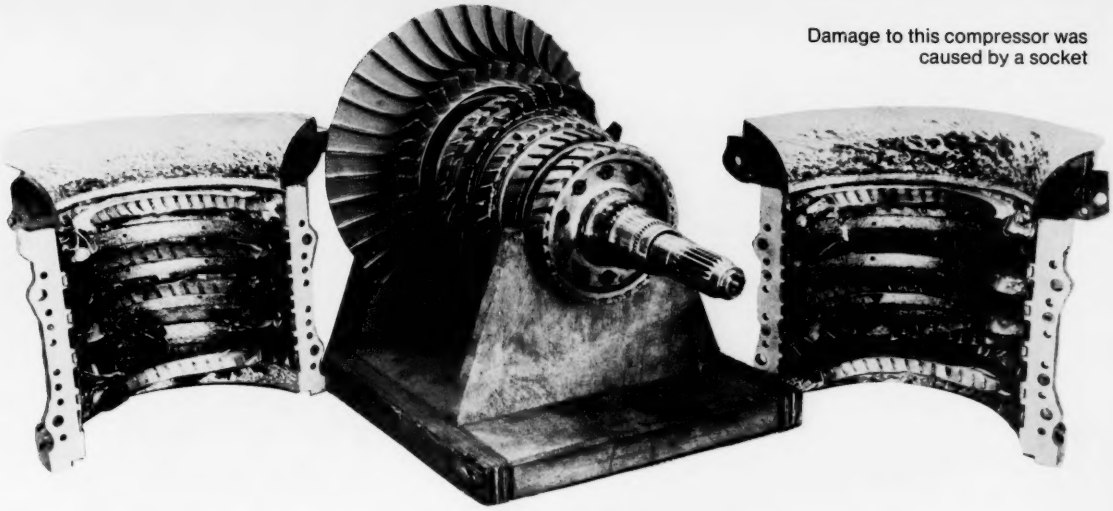
The DARCOM Project Office for Aviation Life Support Equipment (DRCPO-ALSE) and PEARL have new telephone numbers. The commercial number is (314) 263-0614 and the AUTOVON number is 693-0614 or 0617. Many other offices at the Troop Support and Aviation Materiel Readiness Command (TSARCOM) St. Louis, MO also have new numbers. Listed are the AUTOVON numbers of some which I think will be of interest to you. All have an AUTOVON prefix of 693:

Commanding General	2201
Directorate Maintenance	2423
Directorate Materiel	3176
Directorate International Logistics	2807
Directorate Product Assurance	3478
Directorate Procurement & Production	3125
Directorate Comptroller	2001
Directorate Management Information	3371
Directorate Systems Management	2306
Cobra Project Manager	0935
Integrated Logistics Support	2723
Aviation Safety	0624
Field Services Activity	2423
Special Electronic Mission Aircraft	0899
Amphibians & Watercraft	2361
Inspector General	2166

Kathleen King
Photo by Tom Greene

FOD still in the limelight





Damage to this compressor was caused by a socket

LIKE BAD WEATHER, FOD problems seem to come in cycles. But unlike the weather, which we can predict with reasonable accuracy, we have no way of knowing when or where we may find ourselves caught in a sudden downpour of FOD. Despite publicity given the problem in recent issues of FLIGHTFAX as well as in a pamphlet distributed this past January, we are still having a steady shower of mishaps from this cause.

Based on the mishap rate established during January and February of this year, we can expect FOD-related mishaps to nearly double those of 1978 and more than triple those of 1977.

We can group FOD mishaps into five general categories. The first concerns those mishaps that result from failure of maintenance personnel and pilots to ensure engine inlets, screens, and compressors are clean. In the past, this cause factor has produced a variety of in-flight problems and mishaps. Today, it appears only rarely, showing what can be done when personnel become sufficiently concerned about a problem and direct their efforts towards eliminating it.

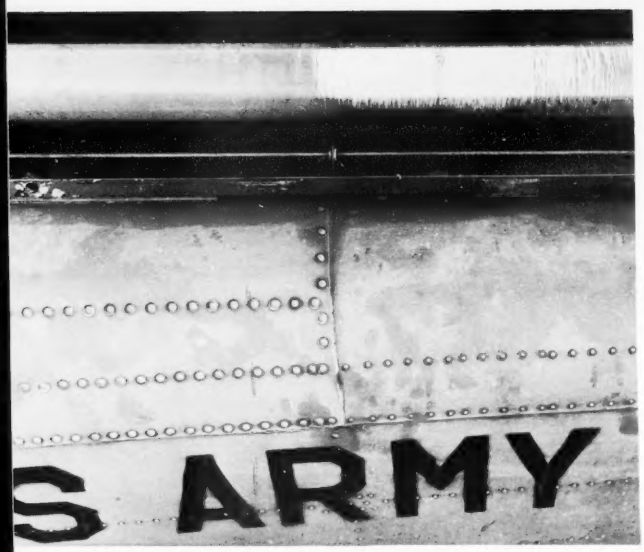
The second category involves foreign objects ingested by engines or drawn into rotor blades because of materiel failures directly or indirectly induced by maintenance. Engine ingestion of Dzus fasteners and improperly secured cowlings coming loose and striking rotor blades are common examples. While mishaps from this cause do not occur often, they are highly significant in that they pose a serious threat to the safety of personnel and equipment and result in high costs for engine replacement and other damages they cause. The solution to this problem lies in proper maintenance and thorough inspections.

Foreign objects ingested by engines or drawn into rotor systems when aircraft are being operated out of unprepared areas make up the third category. Mishaps resulting from this cause—like those produced by maintenance-induced materiel failures—seriously threaten the safety of occupants and usually result in high costs for repairs. On one occasion, a dead tree limb blew into the main rotor system of a UH-1 while the pilot was making a confined area landing. In another instance, the No. 1 engine of a CH-47 exploded and burst into flames during takeoff. While following emergency procedures to extinguish the fire, the pilot applied thrust to land in a clear field. The No. 2 engine then failed from debris thrown from the No. 1 engine, and rotor rpm decayed. However, the pilot was able to successfully land the aircraft with no further damage. Inspection revealed failure of the No. 1 engine was caused by ingestion of a piece of wood, a portion of which was found lodged in the power turbine.

Like inadvertent bird strikes, FOD-related mishaps from operating out of unimproved LZs are the most difficult to prevent. Careful selection of sites, coupled with ground and air reconnaissance, when possible, is the best insurance against this threat. Nevertheless, some element of risk will always be present.

Failure of personnel to ensure the security of items aboard aircraft and on the ground in areas of flight operations and carelessness in handling loose objects in and around operating aircraft make up the fourth major category of FOD-related mishaps. These mishaps occur quite often, and a look at some examples shows the need for a genuine effort to curb them.

- After a UH-1 was landed, an unsecured marker panel blew into the main rotor, damaging one blade.
- As a CH-47 was landing, an unauthorized marker panel blew into the main rotor system, causing incident damage.



Scratches on drive shaft caused by wire

• While a CH-47 was hovering in a pickup zone, a loose straw haul bag was drawn into the aft rotor system, damaging one blade.

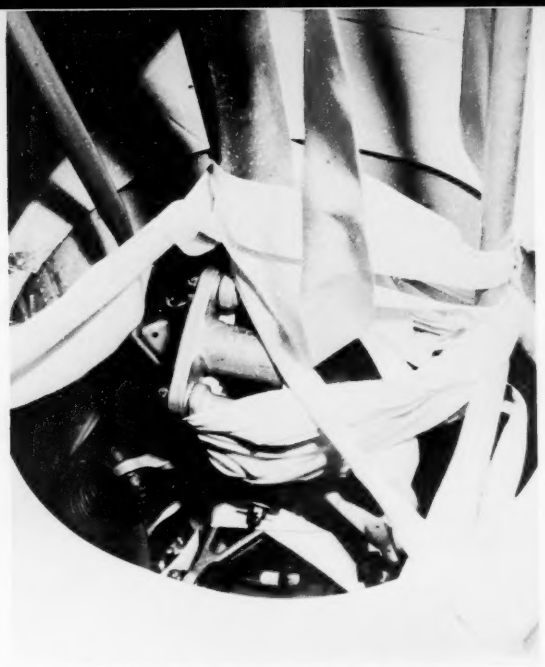
• When an observer started to exit an OH-58, he pitched his gear forward to free his hands so that he could secure the seatbelt. The equipment was drawn out of the aircraft and into a main rotor blade.

• After a pilot completed an area reconnaissance, a tactical map in a plastic case blew out of the hands of an observer. On exiting the aircraft, it struck the left FM homing antenna, ripping it from the aircraft.

• A jacket belonging to a UH-1 crew chief blew out of the cabin and into a main rotor blade during flight.

While most mishaps of this nature produce incident damage, the potential for serious accidents is always present. A case in point concerns a back cushion that came loose from the passenger seat of an OH-58 during flight. After exiting the aircraft, it struck the tail rotor, causing loss of directional control. The end result was a fatal accident.

Preventive measures include ensuring that individuals are fully aware of the need to secure loose objects aboard aircraft and on the ground in areas of flight operation and providing adequate supervision to make sure they do so.



Engineer tape around mast and controls

By far, most instances of FOD result from the careless actions of maintenance and other ground support personnel during the performance of their assigned duties. Mishap files abound with examples.

• A bucking bar left under the tail rotor drive shaft cover of an AH-1 damaged the drive shaft and clamp.

• A spool of safety wire left in the area of the 42-degree gearbox of a UH-1 damaged the gearbox covers, tail boom, drive shaft, and couplings. A pair of duckbill pliers and a pair of wire cutters were also found near the spool of safety wire.

• An unused nut in contact with the main gearbox magnetic plug of a CH-54 caused the main transmission chip detector light to come on during flight. The pilot made a precautionary landing to an unimproved LZ. The nut had gotten into the system when the transmission was rebuilt.

• A rag in the oil cooler fan of an OH-58 caused the oil temperature to exceed the red line during flight.

• A torque wrench forgotten on top of the rotor head of an AH-1 was slung into the tail boom when the engine was started. In a similar instance, a 12-inch crescent wrench left on the rotor head of an AH-1 went into a main rotor blade. A third mishap occurred when a forgotten 16-ounce ballpeen hammer was struck by a main rotor blade of an AH-1.

• A piece of steel safety wire about 4 inches long caused an electrical short circuit inside the a.c.-d.c. junction box of an OV-1. The normal and emergency inverter circuit breakers popped, caution lights came

on, and smoke flowed out of the remote circuit breaker panel in the aft equipment bay.

- A hammer binding against the left lateral servo of a UH-1 caused the aircraft to be slow in responding to aft cyclic inputs.
- A 5/16-inch bolt 1½ inches long, found at the base of the pilot's collective, prevented the pilot of a UH-1 from fully lowering collective during flight.
- An oil sample bottle cap inadvertently dropped into the reservoir of an OH-58 blocked oil flow and caused oil pressure to decrease to zero during takeoff.

In some instances, foreign object damage occurred while maintenance or other support personnel were working on or around aircraft. In one such case, the pilot of an OH-58 was performing a 7-day runup, with the aft cowling removed to check for leaks. Noting leakage around the engine oil bypass switch, the mechanic started to wipe off excess oil to find the source of the leak. The rag he was using became caught on the drive shaft coupling and was jerked from his hand. The loose rag was then ingested by the blower assembly, damaging the blower.

In another instance, an AH-1 was being ground operated while armament personnel worked on the weapons systems. When a mechanic tossed a pair of pliers, they went into the main rotor, damaging one blade.

A third instance involved a fire guard playing with rocks while standing forward of an operating CH-47. During runup, the IP saw a rock leave the fire guard's hands and go into the forward blades. Noting a puff of dust, he shut down the engines. One blade was damaged.

FOD is not merely a costly nuisance but a definite threat to personnel safety, aircraft integrity, and mission accomplishment. With few exceptions, such as damages caused by environmental factors beyond our control, FOD-related mishaps are, for the most part, inexcusable.

Making sure personnel remain aware of the hazards and causes of FOD is the first step toward eliminating this problem. Following good housekeeping practices, performing toolbox inventories, and securing all loose items in and around operating aircraft are all definite musts. But the principal factor that will determine whether or not efforts to curb FOD will be successful is adequate supervision.

FOD is a bad act that has been in the limelight much too long. It's time to bring down the curtain and put an end to its performance.

Exposure to CS gas

INCREASED EMPHASIS on realistic chemical and biological tactical training merits special consideration for the aviation community. While the use of CS gas in ground and air operations is not without risks, exposure to CS can be dealt with in a reasonable manner by Army aircrewmembers.

Following are some health and safety rules-of-thumb for the aircrewmember anticipating exposure to CS gas:

- Always carry your protective mask when in a situation where CS may be used and put it on immediately upon detection of CS (within 10 to 15 seconds). In those situations where CS use is expected (as during field training exercises), at least one pilot in a two-pilot aircraft must wear the protective mask during the entire mission. Likewise, the pilot of a single-pilot aircraft must wear the protective mask during the entire mission when CS use is expected.
- If you have been exposed to CS and did put on your protective mask within 10 to 15 seconds after detection, do change your outer garments and shower before flying again or resuming aircraft maintenance activities in a CS-free environment without your protective mask.
- If you have been exposed to CS and were *not* able to put on your protective mask within 10 to 15 seconds after detection, do not fly or maintain aircraft for 12 hours or until the symptoms of irritation to the linings of the breathing passages and burning of the skin disappear, whichever is longer. In addition, do shower and change your outer garments before resuming aviation activities.

If more information is needed, contact the U.S. Army Safety Center flight surgeon, AUTOVON 558-6788/3819, commercial 205-255-6788/3819.

Helping Hand

SSG Philip B. Hale Jr.
U.S. Army Proving Ground
Dugway, UT

(L-R) SGT Mike Morris, crewchief; CW2 Edward L. Helquist and CW3 John D. Ferguson, Army aviators. Army photo by O. Kraut

U.S. AIR FORCE Reserve Major Bruce Brandt probably owes his life to an Army helicopter crew from Dugway's Michael Army Airfield.

MAJ Brandt was on a training flight with four other F-105 "Thunderchiefs" of the 508th Tactical Fighter Group, U.S. Air Force Reserve from Hill AFB, UT when something went wrong with his fighter. He was forced to eject at high speed over the Great Salt Lake Desert northeast of Wendover, UT.

CW3 John D. Ferguson, CW2 Edward L. Helquist and SGT Mike Morris, with medical assistance from the Dugway Health Clinic, had been called out at 1400 hours, 3 March by MAJ Siebolt of the Coordinated Search and Rescue Office at Scott AFB, IL to search for a twin engine civilian aircraft believed to have crashed about 24 miles east of Elko, NV.

The crew took off on that mission at 1455 hours and were en route to the area when, at about 1530 one of MAJ Brandt's wingmen reported that one of the fighters had crashed in the desert.

"From where we were, near Wendover, we could see the cloud billowing from the desert floor," said CW2 Helquist. "Our first impression was that the pilot had had it."

Because they do not carry radios in the helicopter capable of receiving Air Force tactical frequencies, the crew did not hear the wingman advise Hill that a parachute had been spotted.

"We made ourselves available to Clover (Hill range and airspace control at Salt Lake City) and about 5 minutes later they gave us the go-ahead and informed us there had been a chute spotted," CW2 Helquist continued.

"The wingman who first spotted the crash circled the area and, coupled with the cloud of smoke, made the site easy to spot," CW3 Ferguson added. "We then set down about 50 feet from where the pilot was lying.

"The wreckage was everywhere, the biggest piece of the jet was a radio console that was thrown about 100 feet from the pilot," CW2 Helquist said.

Sergeant Morris was the first man out of the helicopter when it landed. "I thought we would be on a mountain rescue, so I wasn't wearing overshoes, just combat boots," he relates. "When I stepped off the helicopter, I sank in about a foot of water and mud. The skids were completely covered.

"The pilot was lying in about 3 inches of water and 6 inches of mud. He was conscious when I reached him." Sergeant Morris continued. "I asked him if he was hurt and he said that his neck and leg hurt. I reassured him that he'd be all right and went back to the helicopter to get the litter."

"He was having some trouble getting the parachute harness off," CW3 Ferguson explained.

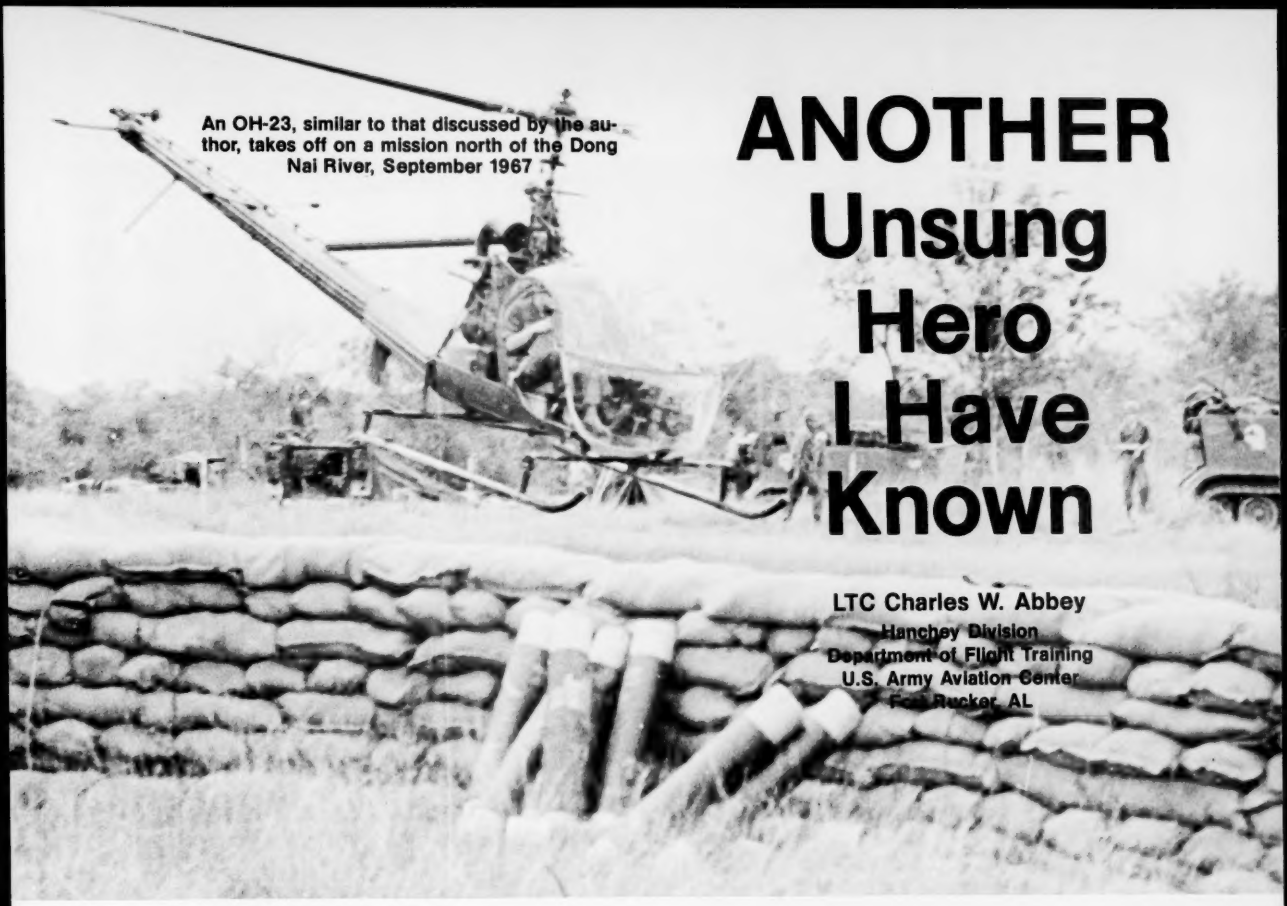
"I ruined my pocket knife trying to cut the straps off his shoulders before I realized they were reinforced with metal strands," Sergeant Morris added.

"Mr. Helquist (a veteran of more than 7 years as a medevac pilot in the United States, Germany and Vietnam) went to help extricate him from the harness and transfer him to the litter," CW3 Ferguson said.

Once aboard the helicopter, they flew MAJ Brandt to Hill AFB Hospital where he is listed as stabilized in satisfactory condition with displaced vertabrae in his neck. The doctors at Hill attribute proper handling en route with keeping the injuries from being more serious.

"Darkness and adverse weather near the site of the original mission near Elko precluded us from getting back to look for that crash site," CW3 Ferguson stated.

When the search was resumed by Air Force and Civil Air Patrol personnel the next day, they located the crash. Apparently, all four occupants of the plane died on impact.



An OH-23, similar to that discussed by the author, takes off on a mission north of the Dong Nai River, September 1967

ANOTHER Unsung Hero I Have Known

LTC Charles W. Abbey
Hanchey Division
Department of Flight Training
U.S. Army Aviation Center
Fort Rucker, AL

ORGANIZATIONAL innovations in my unit in Vietnam, circa 1967, replaced our UH-1C Huey gunships with four OH-23G Raven observation helicopters. Several personnel changes also were made to accommodate aviator qualifications and other considerations except for me—their section commander—who got to "stay put" and sort it all out.

Because I hadn't flown the "23" since flight school at Camp Wolters, TX (about 6 years prior), I needed to reestablish my currency in the aircraft before I could be judged safe to fly. Unfortunately, none of our OH-23 fleet was equipped with a set of dual flight controls—and, in spite of a thorough search, none could be found in the country.

What could I do? Aviation regulations of the day suggested that a set of controls for the instructor pilot, as well as the student, was a nice idea when imparting flying skills to an aviator whose qualifications were uncertain. Since we didn't *have* any, I hemmed and hawed about as long as I felt I could and then asked for a volunteer to accompany me into the wild blue—sans controls—and get me checked out.

In a weak moment of unbridled loyalty and the "can-do" spirit, my lone chief warrant officer instructor pilot took one step forward and volunteered to "guts it out" with "them as had to be checked." He did so—we did so—gingerly and by-the-numbers. He guided me professionally and thoroughly through the requalification process without incident or even a frightening moment.

I chose to consider his act one of modest bravery. This professional aviator balanced the importance of the mission with his estimate of my ability against his anxiety (which I am *sure* he felt). *He* demonstrated the qualities of judgment and competence expected of all our warrant officer (and commissioned) Army aviators today. Granted, his decision was flavored by the *combat environment* and the fact that if *I* couldn't fly, *he* would have to fly his share of my 25 percent of the load—but he didn't *have* to. He *could* have taken me around the pattern once and "kissed me off" to learn by trial and error. Instead, he followed the rules as closely as our mission would allow and gave aviation instruction in the highest tradition expected at the U.S. Army Aviation Center at Ft. Rucker, AL.

It is not often that we send our warriors into difficult situations without a means to influence their destinies (except to talk calmly and to smile a lot), but when we must and when they perform so well, they deserve a salute.

ATC ACTION LINE

UNITED STATES ARMY COMMUNICATIONS COMMAND

When ATC tells me they have radar contact, what does that mean to me? What service can I expect?

First of all, *radar contact* is a term used by ATC to inform an aircraft that it is identified on the display and *radar flight following* will be provided until radar identification is terminated. *Radar service* also may be provided within the limits of necessity and capability. When a pilot is informed of "radar contact" the pilot automatically discontinues reporting over compulsory reporting points.

To explain further, the term "radar flight following" is officially defined as the observation of the progress of radar identified aircraft, *whose primary navigation is being provided by the pilot,* wherein the controller retains and correlates the aircraft identity with the appropriate target or target symbol displayed on the radar scope.

If you are receiving "radar service," you are receiving one or more of the following:

- **Radar Separation**—Radar spacing of aircraft in accordance with established minima.
- **Radar Navigational Guidance**—Vectoring aircraft to provide course guidance.
- **Radar Monitoring**—The radar flight following of aircraft, whose primary navigation is being performed by the pilot, to observe and note deviations from its authorized flight path, airway or route. When being applied specifically to radar monitoring of instrument approaches, i.e., with precision approach radar (PAR) on radar monitoring of simultaneous instrument landing system (ILS) approaches, it includes advice and instructions whenever an aircraft nears or exceeds the prescribed PAR safety limit or ILS no transgression zone.

"Radar service terminated" is the term used by ATC to inform the pilot that services will no longer be provided that could be received while under radar contact. Radar service is automatically terminated and the pilot is not advised in the following cases:

- An aircraft cancels its instrument flight rules flight plan, except within a terminal control area, terminal radar service area or where Stage II service is provided.
- At the completion of a radar approach.
- When an arriving aircraft is advised to contact the tower.
- When an aircraft conducting a visual approach or contact approach is advised to contact the tower.
- When an aircraft making an instrument approach has landed or the tower has the aircraft in sight, whichever occurs first.

Readers are encouraged to send questions to:
Director
USAATCA Aeronautical Services Office
Cameron Station, Alexandria, VA 22314

So You Want To Be An Aeroscout

INFORMATION ON how to fly aeroscout missions has always been hard to find – until now. The student handout "Aeroscout Combat Skills" which was developed by the Attack/Aeroscout Branch at Ft. Rucker, AL for the Initial Entry Aeroscout Course is now available for distribution. The handout goes into quite a bit of detail about such things as zone reconnaissance, route reconnaissance, screen missions, area security operations, artillery adjustment, and attack helicopter operations, to name only a few of the topic areas.

To get your copy, call AUTOVON 558-5990, or write Department of Academic Training, ATTN: ATZQ-T-AT-TLMB, Ft. Rucker, AL 36362, and request "Student Handout, Aeroscout Combat Skills in Support of 5-4023-143, 84-9673-104."

ATC Maintenance Technician

Specialist Gallagher Named Army's Best for 1979

Specialist 6 George D. Gallagher, selected as the Army's best Air Traffic Control Maintenance Technician for 1979, checks a ground control approach radar unit at Ft. Rucker's USACC area maintenance facility. (U.S. Army photo by PFC Jeff Garnett)

SPECIALIST 6 George D. Gallagher of Ft. Rucker, AL has been named the Army's Air Traffic Control Maintenance Technician of the Year for 1979.

Selected earlier as the best technician in the United States, SP6 Gallagher won the worldwide title over representatives of Army units in Korea and Europe. Judging was conducted at the Army Communication Command (USACC) headquarters, Ft. Huachuca, AZ.

SP6 Gallagher works in the USACC area maintenance facility at Ft. Rucker where electronic equipment for Army aviation units in the United States, Panama, Alaska and Hawaii is maintained and repaired.

According to SP6 Gallagher's nomination, "he has totally dedicated himself to the accomplishment of the facility mission" and "has proven that his technical expertise is exceeded only by a very few individuals." It further indicates that he works without supervision and does the most difficult jobs quickly and efficiently.

"We can do a lot of problem solving over the telephone," SP6 Gallagher said, "but if that's not possible, then the unit has to send the piece to us or we have to go where it is."

Many times the latter occurs. For instance, the award-winning technician recently has made trips to Army airfields in Texas, Kansas, Louisiana, Washington and California.

The travel adds to his enjoyment of the job, even though sometimes he finds he's involved in a shocking business.

SP6 Gallagher laughingly admitted that he expects "to get burned" at least once a day when he is working with radar units that have an output of about 4,000 volts, no matter how careful he tries to be.

In addition to apparently being shock-proof, an electronics technician also needs a lot of patience.

"If they made a piece of equipment—a recorder, a computer, a radar or whatever—and it worked once, then you know you can make it go again," he said. This skill and proficiency makes that confidence a reality for SP6 Gallagher, although not always easily.

The specialist has been in the Army since May 1968 and has spent almost 7 of those 11 years overseas. He served in Vietnam from October 1969 to October 1970 and in Germany from February 1972 until he arrived at Ft. Rucker in November 1977. *PAO—Ft. Rucker.*

Fort Rucker's First Black Hawk

Major General James H. Merryman, commanding general, Ft. Rucker, AL, accepts the Army Aviation Center's first two UH-60 Black Hawk helicopters in a ceremony 25 April. In his speech, the general said the new aircraft will give Army commanders the ability to move an entire infantry squad at one time. Seated are from left: Gerald J. Tobias, president, Sikorsky Aircraft, Stratford, CN; Bill Crawford, military programs manager, General Electric Aircraft Engine Division, Lynn, MA; and COL(P) Richard D. Kenyon, Black Hawk project officer, Aviation Research and Development Command, St. Louis. (U.S. Army photo by SP4 Dan Splaine)

ARMY AVIATION 37th Birthday

The Army Missile Research and Development Command (MIRADCOM) at Redstone Arsenal, AL earlier this year launched a laser-guided HELLFIRE (Helicopter Launched Fire and Forget) missile down a Redstone test range. Launched from a low flying AH-1 Cobra, the missile "homed" on and hit a stationary target illuminated by MIRADCOM's Ground Laser Locator Designator. HELLFIRE will be fielded in the early 1980s. It is planned as the primary armament on the Army's new AH-64 advanced attack helicopter